UNITED FRUIT COMPANY

General Offices: **Boston, Massachusetts**

Medical Department

FIFTEENTH
ANNUAL REPORT

1926

THE PROPERTY OF
THE WELLCOME BUREAU
OF SCIENTIFIC RESEARCH

EX LIBRIS

WELLCOME BUREAU OF SCIENTIFIC RESEARCH

LONDON

22502961426

v. 3

UNITED FRUIT COMPANY

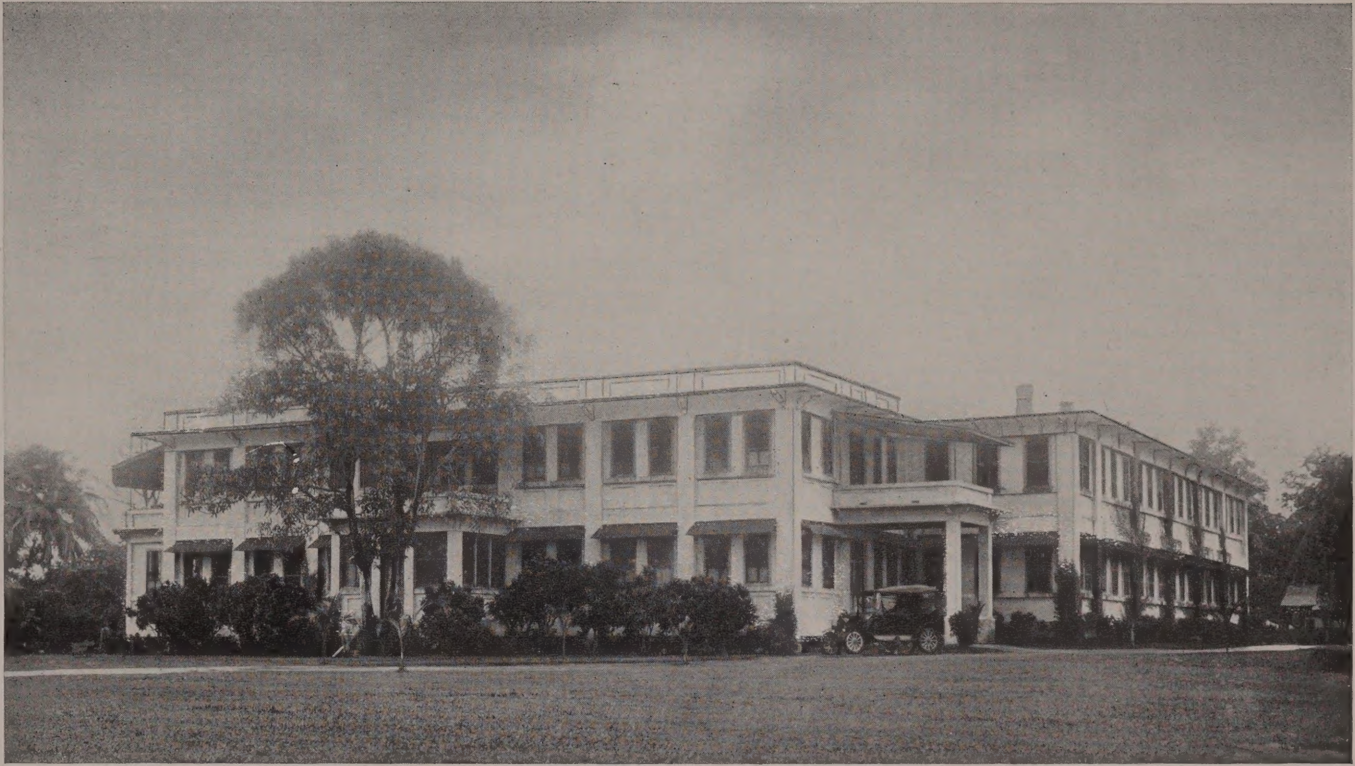
General Offices: Boston, Massachusetts

Medical Department

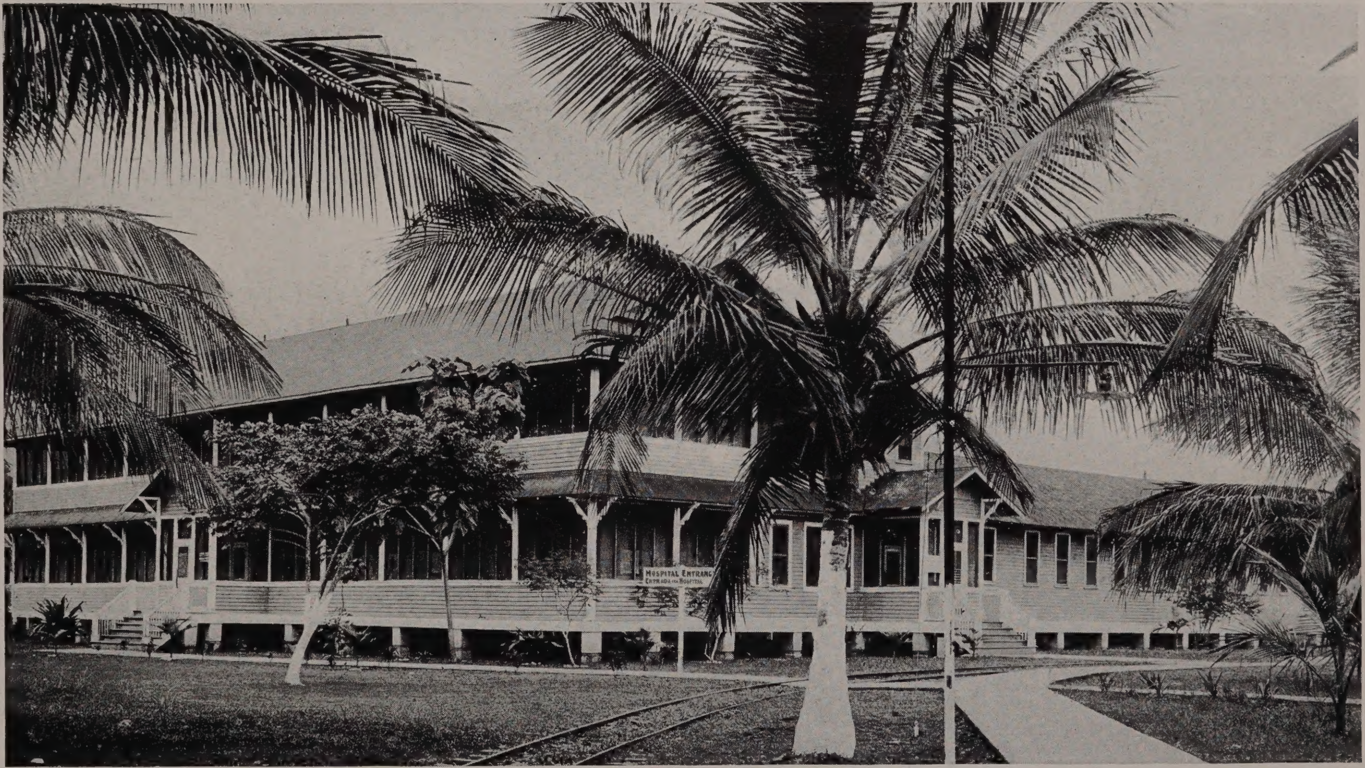
FIFTEENTH
ANNUAL REPORT

1926

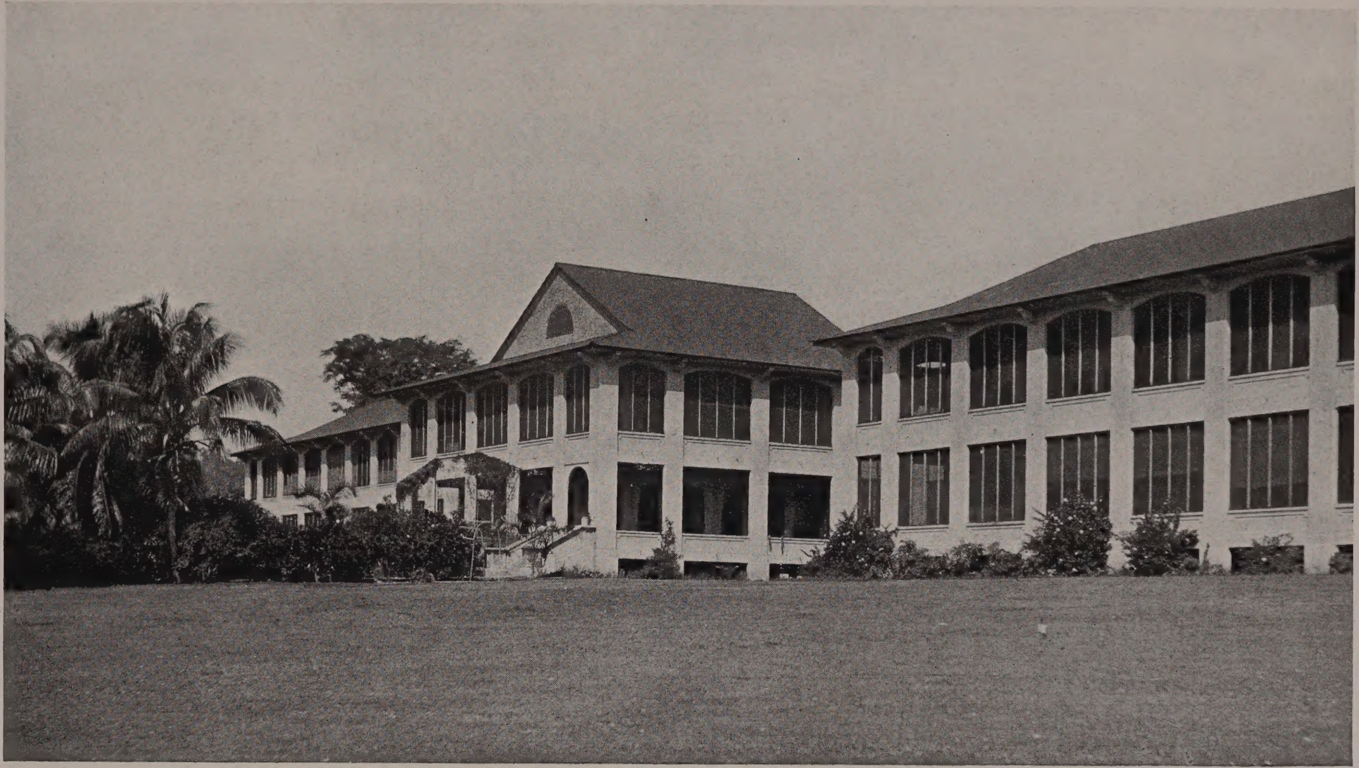
WELLCOME
LIBRARY
Ann Rep
WA28
.EM4
U58
1926



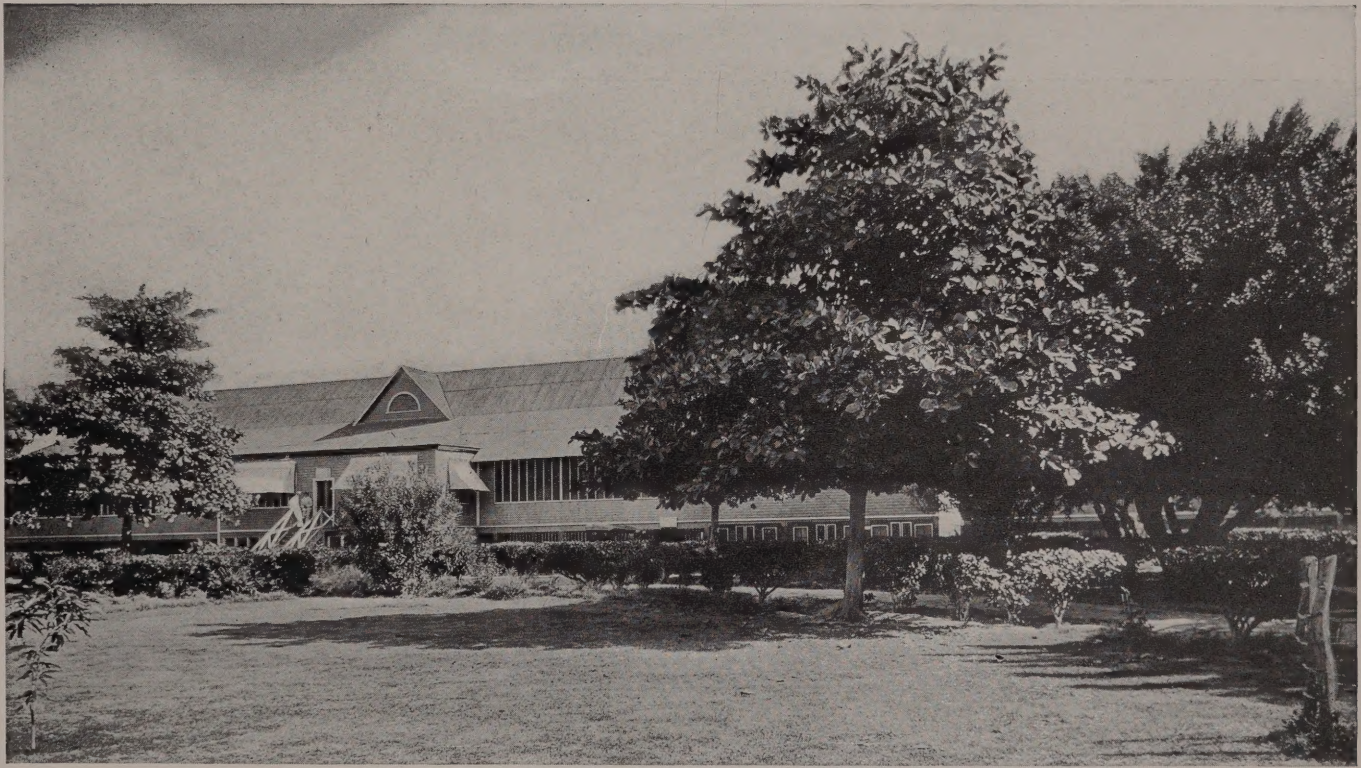
United Fruit Company Hospital at Port Limon, Costa Rica



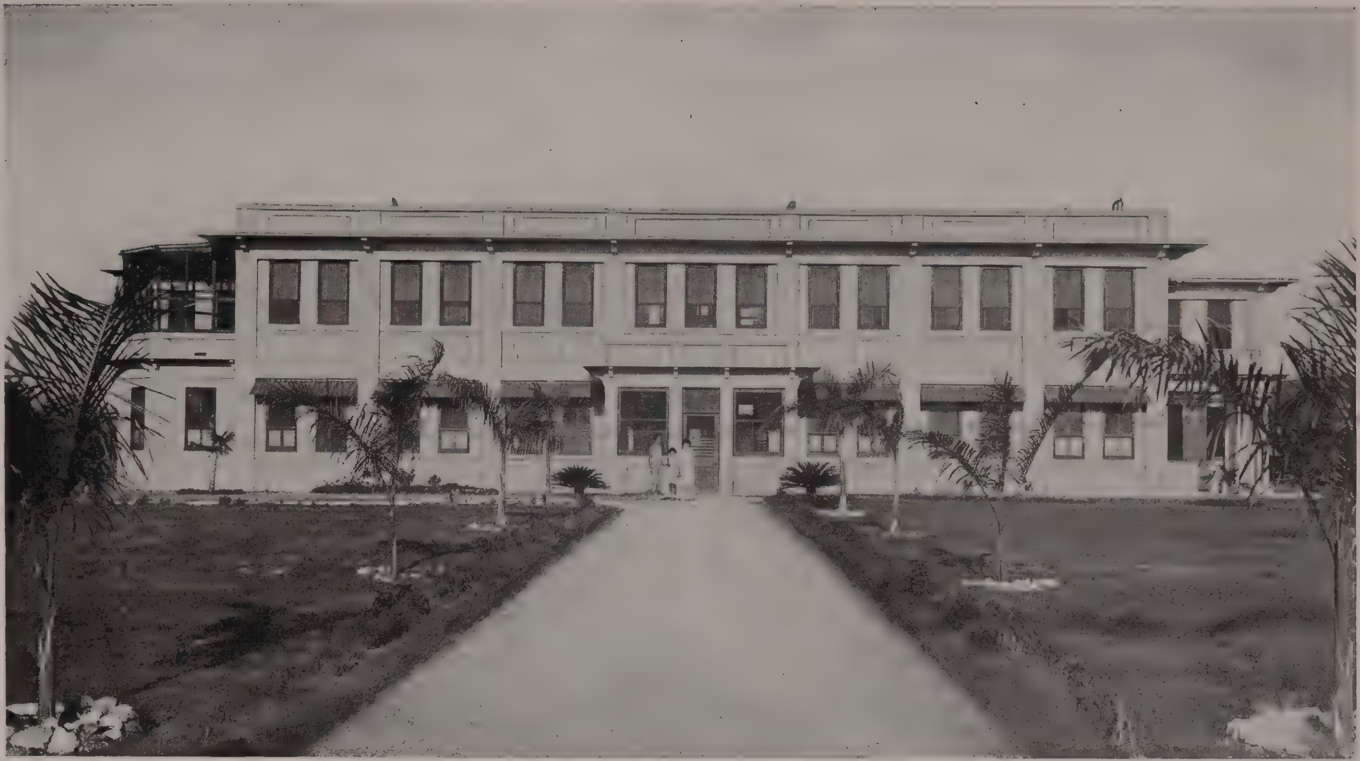
United Fruit Company Hospital at Almirante, Panama



United Fruit Company Hospital at Quirigua, Guatemala

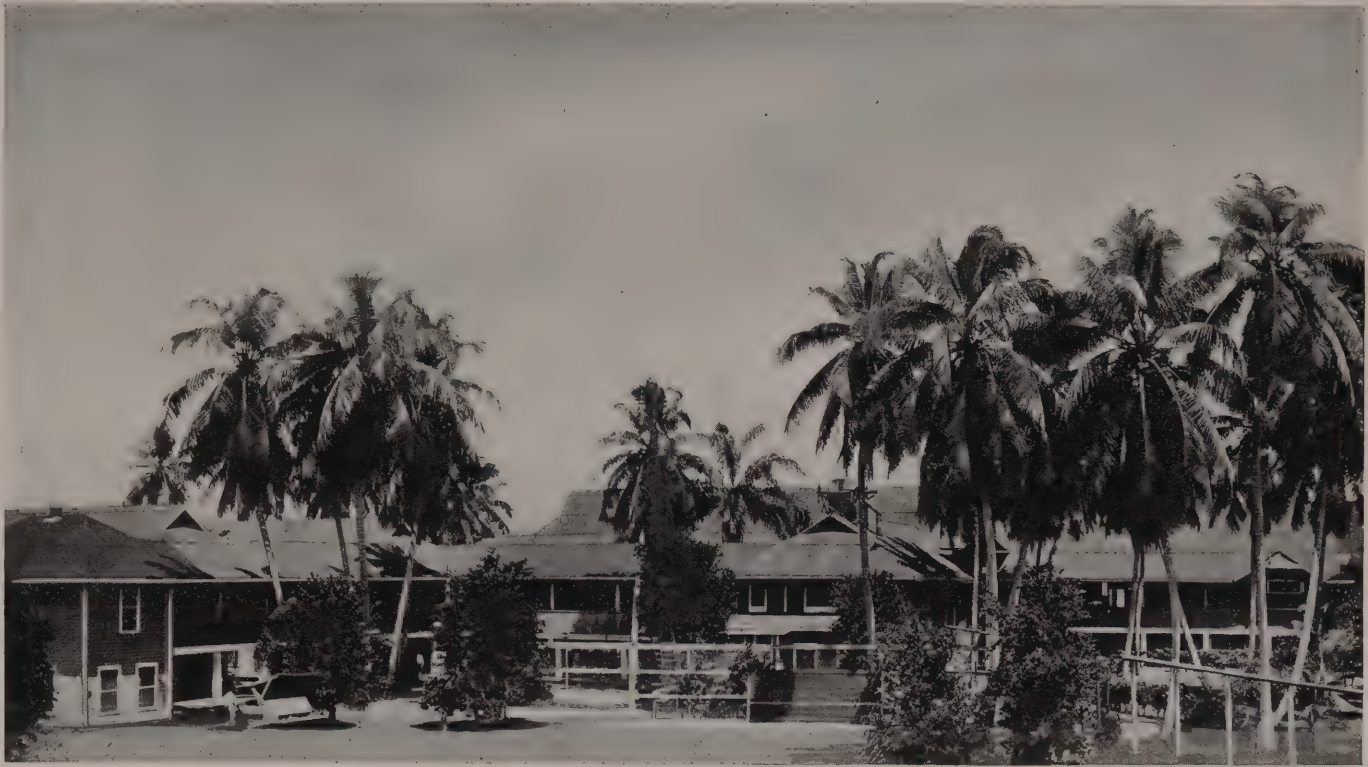


United Fruit Company Hospital at Santa Marta, Colombia



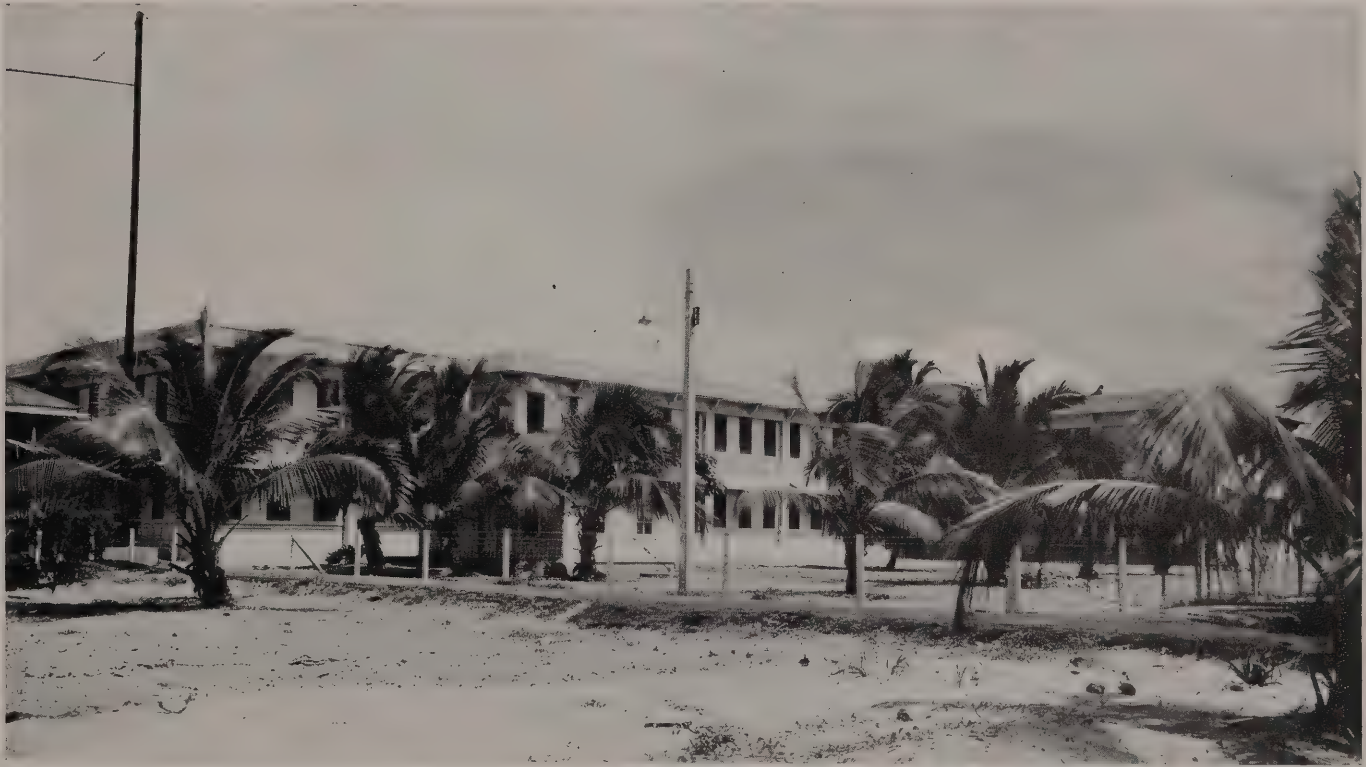
United Fruit Company Hospital at Preston, Cuba

United Fruit Company Hospital at Banes, Cuba



Tela Railroad Hospital at Tela, Honduras

REAR VIEW—FOLIAGE PREVENTS OBTAINING SATISFACTORY FRONT VIEW



Truxillo Railroad Hospital at Puerto Castilla, Honduras

CONTENTS

SECTION I

PAGE
Letter of Transmittal 15
Extracts from Letters of Transmittal of Medical Superintendents 18
The Selection of Labor Recruits 21
Wilhelm Cordes, M.D., Preston Hospital, Cuba

SECTION II

Some Recent Additions to Our Knowledge Concerning Malaria, and Our Present Plan for Its Control 25
Extracts from the Report of S. P. James and P. G. Shute on Studies in Malaria
Anopheles Mosquitoes in Our Tropical Divisions 45
A Compiled Report, H. C. Clark, M.D., Director of Laboratories and Preventive Medicine, United Fruit Company, New York
Some Notes Relating to Malaria and Blackwater Fever 47
Banes Hospital, Cuba
A Precipitin Test in Malaria 48
William H. Taliaferro, Ph.D., Lucy Graves Taliaferro, Sc.D., and Anna B. Fisher, M.S.
Mercurochrome 220 Soluble in the Treatment of Malaria. 60
H. M. Walker, M.D., Truxillo Railroad Company Hospital, Puerto Castilla, Honduras
Treatment of Haemoglobinuric Fever with the Use of Haemostatic Serum Intravenously 63
Ricardo Aguilar, M.D., Quirigua Hospital, Guatemala
Experiences with Plasmochin in Malaria (Preliminary Reports) 66

SECTION III

Remarks on the Diagnosis of Intestinal Amoebiasis 82
W. M. James, M.D., F.A.C.P., Chief of Medicine, Herrick Clinic, Panama
The Classification of Bacterial Dysenteries and of Dysentery Bacilli . . . 89
Aldo Castellani, M.D., F.R.C.P., Professor of Tropical Medicine, Tulane University, New Orleans
Lobar Pneumonia 103
H. M. Walker, M.D., Puerto Castilla Hospital, Honduras
An Unusual Case of Cerebrospinal Meningitis, Due to the Pneumococcus Lanceolatus, and Its Recovery 105
H. R. Eichelbaum, M.D., Almirante Hospital, Panama
Influenza in the Tropics, with Some Case Reports 108
O. T. Brosius, M.D., D.T.M. and H., Almirante Hospital, Panama
Toxic Cirrhosis and Primary Liver Cell Carcinoma Complicated by Histoplasmosis of the Lung 115
B. M. Phelps, M.D., Truxillo Railroad Company Hospital, Puerto Castilla, Honduras, and F. B. Mallory, M.D., Consulting Pathologist, United Fruit Company, Boston, Mass.
Caraate in Colombia 123
Walter Menk, M.D., Santa Marta Hospital, Colombia

SECTION III (*Continued*)

PAGE

Granulomata Treated with Intravenous Tartar Emetic—A Report of Five Cases . . . 131
W. A. Hutchinson, M.D., Puerto Castilla Hospital, Honduras

Notes on Goiter . . . 135
Jaime de la Guardia, M.D., United Fruit Company Hospital, Preston, Cuba

Report of a Case of Gynatresia . . . 137
Ricardo Aguilar, M.D., Quirigua Hospital, Guatemala

Sodium Thiosulphate in Bichloride of Mercury and Arsenical Intoxications—Report of Three Cases . . . 138
Manuel D. Rojas, M.D., Port Limon Hospital, Costa Rica

Case Reports of *B. Typhosus*, *B. Paratyphosus*, and *B. Coli* Infections, Complicated by Tropical Diseases . . . 141
O. T. Brosius, M.D., Almirante Hospital, Panama

Incidence of *B. Paratyphosus A* and *B* in Stools . . . 146
Walter Menk, M.D., and J. C. Register, Laboratory Technician, Santa Marta Hospital, Santa Marta, Colombia

A Case of Clonorchiosis . . . 147
Wilhelm Cordes, M.D., Preston Hospital, Cuba

A Case of Congenital Aphacia . . . 148
H. R. Eichelbaum, M.D., Almirante Hospital, Panama

SECTION IV

Syphilis in the Tropics—with Case Reports . . . 149
O. T. Brosius, M.D., I. E. Peon, M.D., and H. R. Eichelbaum, M.D., Almirante Hospital, Panama

Syphilis and Framboesia among Haitian Laborers in Cuba . . . 156
Wilhelm Cordes, M.D., Preston Hospital, Cuba

Treatment of Acute Gonorrhoeal Epididymitis by Intravenous Injection of Sodium Iodide . . . 164
W. A. Hutchinson, M.D., Truxillo Railroad Company Hospital, Puerto Castilla, Honduras

The Percentages of Positive Wassermann Reactions Found Associated with Various Diseases . . . 168
Walter Menk, M.D., Santa Marta Hospital, Colombia

Results Obtained from Four Hundred Blood Examinations with the Meinicke Turbidity Reaction . . . 170
Franz Weiss, M.D., Quirigua Hospital, Guatemala

A Comparison of the Complement Fixation Test (Wassermann Reaction) and Meinicke's Turbidity Reaction (M.T.R.) in Serodiagnosis in the Tropics . 173
Walter Menk, M.D., Santa Marta Hospital, Colombia

Comparison of the Meinicke Turbidity Reaction and the Kahn Precipitation Test . . . 177
Franz Weiss, M.D., Quirigua Hospital, Guatemala

Butler's Serum Diagnosis for Syphilis—A Macroscopic Slide Method (Preliminary Report) . . . 179
H. C. Clark, M.D., Director of Laboratories and Preventive Medicine

SECTION V

Schick Tests upon Inhabitants of Tela, Honduras . . . 183
William H. Taliaferro, Ph.D.

Tela Hospital Laboratory Report, 1926 . . . 184
James C. McDaniel, Laboratory Technician, Tela Hospital, Tela, Honduras

Post-Mortem Summary . . . 186
Walter Jantzen, M.D., Truxillo Railroad Company Hospital, Puerto Castilla, Honduras

PAGE
Fluoroscopy and Its Relative Advantages, Compared with Radiography, and Comments on a New Type of X-Ray Film 189
Sylvia Berg, M.D., Tela Hospital, Honduras

SECTION VI

Streptococcal Subcutaneous Necrosis with Gangrene of the Skin 194
Alfred Gage, M.D., Quirigua Hospital, Guatemala
Severe Fractures Involving the Knee Joint 198
B. M. Phelps, M.D., Puerto Castilla Hospital, Honduras
The Machete Versus the Microbe in Central America 205
Alfred Gage, M.D., Quirigua Hospital, Guatemala . .
A Case Report—Annular Calcified Scar 213
R. B. Nutter, M.D., Tela Railroad Company Hospital, Tela, Honduras
A Supplement to Last Year's Report on the Treatment of Wounds Post-Operatively without Dressings 214
I. E. Peon, M.D., Almirante Hospital, Panama
A Brief Description of an Extensive Injury, with Recovery, and a Simple and Satisfactory Method of Treating Skin Grafts 214
R. B. Nutter, M.D., Tela Railroad Company Hospital, Tela, Honduras
Removal of Cranial Exostosis for Epilepsy 216
E. W. Davis, M.D., Truxillo Railroad Company Hospital, Puerto Castilla, Honduras
A Case Report—Bilateral Tubal Pregnancy 219
L. M. Drennan, M.D., Santa Marta Hospital, Colombia
A Case Report—Severe Secondary Anaemia Treated by Blood Transfusion . 221
R. B. Nutter, M.D., Tela Railroad Company Hospital, Tela, Honduras
Spinal Anaesthesia 223
Jaime de la Guardia, M.D., Preston Hospital, Cuba
Spinal Anaesthesia 227
O. T. Brosius, M.D., and I. E. Peon, M.D., Almirante Hospital, Panama

SECTION VII

The Snake-Bite Problem in the United States and in Central America . . . 229
Afranio Do Amaral, B.Sc. and L., M.D., D.P.H., Director, Antivenin Institute of America, and Lecturer, Harvard University School of Public Health
Cases of Snake-Bite Treated in Almirante Hospital, Panama, during the Years 1922–1926, Inclusive 237
H. R. Eichelbaum, M.D., Almirante Hospital, Panama
Snake-Bites—Special Report from Puerto Castilla, Honduras 240
B. M. Phelps, M.D., Truxillo Railroad Company Hospital, Puerto Castilla, Honduras
Report of Snake-Bite Cases 241
R. B. Nutter, M.D., Tela Hospital, Tela, Honduras
The Biology, Immature Stages, and Control of the Sandflies (Biting Ceratopogoninae) at Puerto Castilla, Honduras 245
Reginald H. Painter, Ph.D., Kansas State Agricultural College
Equine Trypanosomiasis in Colombia (Rengera or Derrengadera) 263
H. C. Clark, M.D., New York, N. Y.
General Instructions for Embalming 266
Medical Department, United Fruit Company

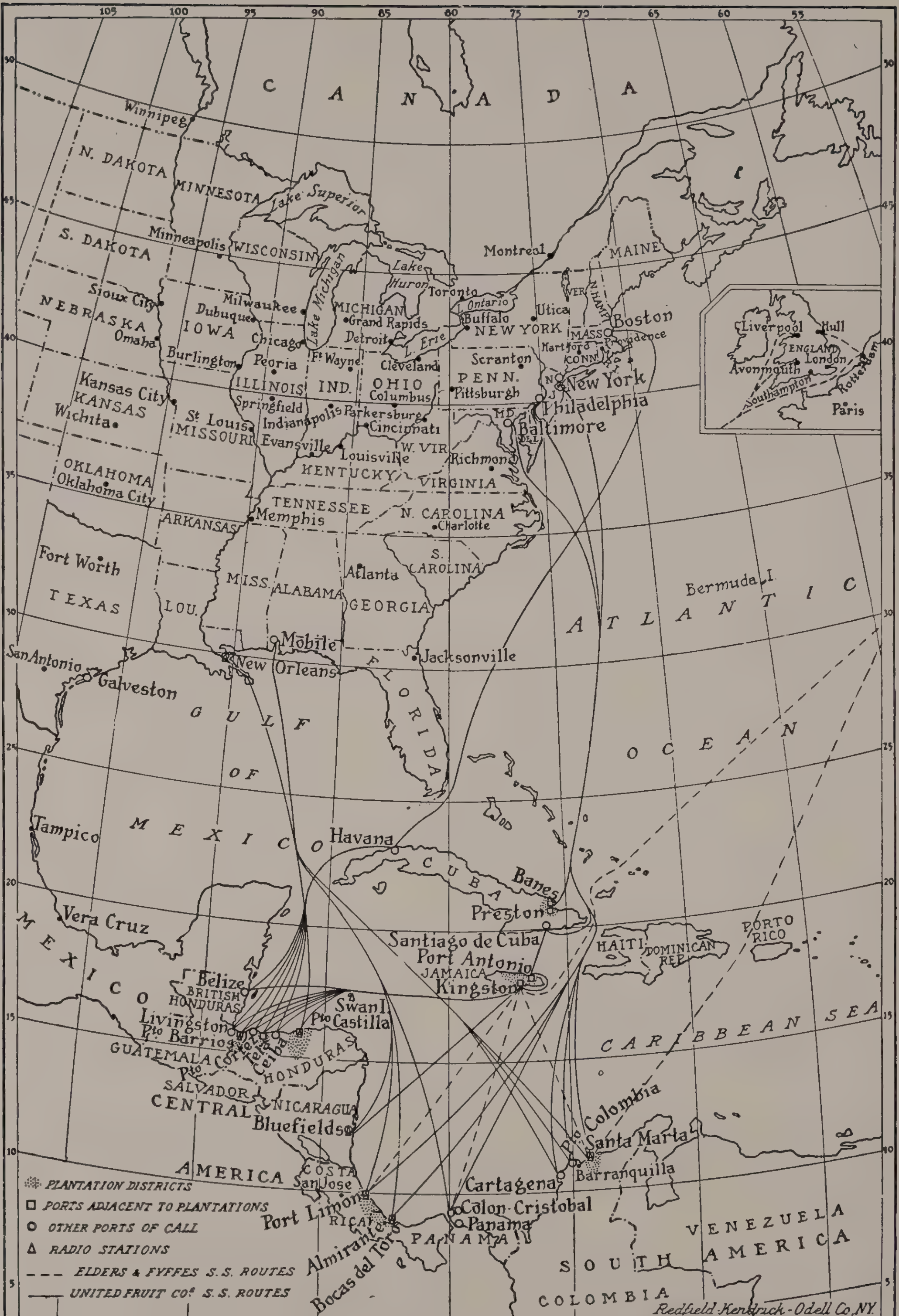
SECTION VIII

PAGE
A Review of "Manson's Tropical Diseases, A Manual of the Diseases of Warm Climates," Edited by Philip H. Manson-Bahr, D.S.O., M.A., M.D., D.T.M. and H. Cantab., F.R.C.P. (Lond.), Eighth Edition, Revised, William Wood and Company, New York, N.Y., 1925 270
Brief Review of "A Manual of the Parasitic Protozoa of Man," by Chas. F. Craig, M.D., M.A. (Hon.); Lieut. Colonel, Medical Corps, U. S. Army, D.S.M., J. B. Lippincott Company, Philadelphia, Pa. 275
A Review of "Protozoology," by C. M. Wenyon, C.M.G., C.B.E., M.B., B.S., B.Sc., Two Volumes, William Wood and Company, New York, N.Y., 1926 278

SECTION IX

ORGANIZATION AND VITAL STATISTICS

Scope of the Medical Department 280
Personnel of the Medical Department 280
Summary of Work Done and Vital Statistics 284–291
Record of Hospitals 292–293
Record of Hospital Dispensaries 294–295
Record of Field Dispensaries 296–297
Deaths by Age, Nativity, and Sex 298–299
Deaths by Nativity 300
Classification of Deaths by Disease 302–309
Record of Repatriations 310–313
Classification of Diseases Treated in Hospitals 314–329
Classification of Diseases Treated in Hospital Dispensaries 330–333
Surgical Report 334–338
Consolidated Laboratory Report 340–343
Number and Classification of X-Ray Examinations 344
Meteorological Report 345
General Statement, Passenger Service 346–347
Classification of Diseases Treated Aboard Passenger Steamships and by Port Medical Officers at New York, New Orleans, and Boston 348
Report of Port Medical Officers and Sanitary Inspector 349–350
Explanatory Notes 351
Index 353–355


CANADA
Winnipeg
N. DAKOTA
MINNESOTA
Lake Superior
S. DAKOTA
Minneapolis
WISCONSIN
Lake Michigan
Lake Huron
Toronto
Ontario
Montreal
MAINE
VER.
N. HAMP.
MASS.
Boston
Providence
Hartford
CONN.
Utica
NEW YORK
Buffalo
Erie
Sioux City
NEBRASKA
Omaha
IOWA
Dubuque
Milwaukee
Chicago
MICHIGAN
Grand Rapids
Detroit
Burlington
Peoria
Ft. Wayne
Cleveland
Scranton
PENN.
Pittsburgh
N.J.
New York
Philadelphia
MD.
DEL.
Baltimore
Kansas City
KANSAS
Wichita
ILLINOIS
IND.
OHIO
Columbus
Springfield
Indianapolis
Parkersburg
Cincinnati
St. Louis
MISSOURI
Evansville
Louisville
W. VIR.
Richmond
KENTUCKY
VIRGINIA
OKLAHOMA
Oklahoma City
TENNESSEE
Memphis
N. CAROLINA
Charlotte
ARKANSAS
S. CAROLINA
Fort Worth
MISS.
ALABAMA
Atlanta
GEORGIA
TEXAS
LOU.
Mobile
Jacksonville
San Antonio
Galveston
New Orleans
FLORIDA
Bermuda I.
ATLANTIC OCEAN
GULF OF MEXICO
Tampico
Havana
CUBA
Banes
Preston
Santiago de Cuba
Port Antonio
JAMAICA
Kingston
HAITI
DOMINICAN REP.
PORTO RICO
Vera Cruz
MEXICO
Belize
BRITISH HONDURAS
Swan I.
Pto. Castilla
Livingston
Pto. Barrios
Pto. Cortez
Tela
Ceiba
GUATEMALA
HONDURAS
SALVADOR
NICARAGUA
CENTRAL AMERICA
Bluefields
CARIBBEAN SEA
COSTA RICA
San Jose
Port Limon
Almirante
Bocas del Toro
Cartagena
Colon-Cristobal
Panama
PANAMA
Pto. Colombia
Santa Marta
Barranquilla
VENEZUELA
SOUTH AMERICA
COLOMBIA
Liverpool
Hull
ENGLAND
London
Avonmouth
Southampton
Rotterdam
Paris
▨ PLANTATION DISTRICTS
□ PORTS ADJACENT TO PLANTATIONS
○ OTHER PORTS OF CALL
△ RADIO STATIONS
— — — ELDERS & FYFFES S.S. ROUTES
——— UNITED FRUIT CO.S S.S. ROUTES
Redfield-Kendrick-Odell Co. N.Y.

SECTION I

UNITED FRUIT COMPANY
GENERAL OFFICES, ONE FEDERAL STREET, BOSTON, MASS.

WILLIAM E. DEEKS, M. D.
GENERAL MANAGER

MEDICAL DEPARTMENT
17 BATTERY PLACE, NEW YORK

April 1, 1927

MR. V. M. CUTTER, President
United Fruit Company
Boston, Massachusetts

Dear Sir:—

The Annual Report of the Medical Department of the United Fruit Company for the fiscal year ended December 31, 1926, is herewith submitted:

During the past year the Medical Department has functioned in a satisfactory manner.

MALARIA AND ITS PROBLEMS

Of the endemic diseases with which we have to deal in our tropical divisions, malaria is the most prevalent and of the greatest economic importance in its relation to labor efficiency. It is directly responsible for from 38 to 40 per cent of all hospital admissions, and causes, either directly or indirectly, more poverty, misery, and loss of man power than all other endemic diseases combined.

As a result of the malaria surveys undertaken by Dr. H. C. Clark and Mr. J. A. Corrigan, considerable light has been thrown upon the breeding places of election of the predominating mosquito vector, *Anopheles albimanus*, and upon the incidence of malaria infection among our employees.

Based on these findings, measures have been instituted in all our divisions, not only for the control of mosquito breeding in the vicinity of the dwellings and camps, but also for early house treatment of infected cases. As a result of these control measures, we hope to reduce the present high morbidity rate of malaria and to establish, by demonstration and local examples, methods of community control which can be carried on by the intelligent units of each tropical division of the United Fruit Company as a routine part of their work. Needless to say, the success or the failure of such measures rests largely upon the cooperation and the combined efforts of the intelligent personnel in charge of labor in each division.

At the time of writing, the progress reports in all these directions are very encouraging.

In the section on Malaria in this Report, these matters are referred to in more detail, and in addition we are submitting extracts from reports of recent investigations and discoveries, which have an important bearing on several problems relating to malaria control.

ANOPHELES INVESTIGATION

We are indebted to Dr. J. A. Bequaert, of the Harvard Medical School, who spent about three weeks in the Cuban divisions for the purpose of identifying the species of Anopheles responsible for the transmission of malaria. He confirmed our previous belief that the *Anopheles albimanus* is the main vector in the Cuban divisions, as is also the case in the other divisions.

PRECIPITIN IN MALARIA CONTROL

Important research work on a precipitin test in malaria was undertaken by Professor W. H. Taliaferro, in Tela. The report of this work appears on page 48. He also made a limited number of Schick tests for diphtheria immunity on the native and foreign populations, and his report appears on page 183.

THE SANDFLY NUISANCE

Professor Reginald H. Painter, of the Kansas State Agricultural College, spent about three months investigating the sandfly nuisance in Puerto Castilla. His comprehensive report appears in Section VII.

U. S. P. H. S. SURVEY

We are also indebted to Dr. M. A. Barber and Mr. W. H. W. Komp of the U. S. Public Health Service for assisting in a malaria survey of prospective Haitian laborers.

DYSENTERY

We are greatly indebted to Dr. Aldo Castellani for his excellent contribution, which contains authoritative information on intestinal conditions and should prove of particular value to all persons interested in tropical medicine (page 89).

AMOEBIASIS REPORT

You will note, too, an important contribution on amoebiasis in this Report, Section III, by Dr. W. M. James of Panama, a member of our Consulting Staff. Dr. James is a recognized international authority on this infection, which is prevalent in some of our divisions; his contribution, therefore, is of great importance in our work. In addition, his reviews (Section VIII) of recent publications on tropical diseases are also greatly appreciated.

GRATIFYING INTEREST OF THE STAFF

It is gratifying to note the scientific interest of the members of the Medical Staff in their work, as evidenced by the increasing number and importance of their contributions.

DISTRIBUTION OF THE ANNUAL REPORT

About five thousand copies of the Annual Report are now distributed (largely by request) to individuals interested in tropical problems, to scientific institutions, and libraries.

This department is grateful for the continued cooperation and support of the officials of the United Fruit Company.

Respectfully,

WEDeeks

EXTRACTS FROM LETTERS OF TRANSMITTAL OF MEDICAL SUPERINTENDENTS

MERCUROCHROME

This drug has been used extensively in our hospitals, both locally and intravenously, during the past year. The general consensus of the opinions of our physicians is that it is of great therapeutic value when used locally in from 2% to 4% solution. When applied to fresh wounds, superficial or deep, it prevents suppuration in most cases; in superficial ulceration, it greatly promotes healing; in suppurative joints, its injection is generally, but not always, followed by excellent results; in suppurative otitis media with perforated drum, its action, in the great majority of cases, can be considered as almost specific.

It is of value, also, in the local treatment of conjunctivitis, pharyngitis, and so on.

In regard to its administration intravenously, a general consideration of the reports made by our physicians who have used it extensively under control conditions leads us to draw the following conclusions:

(1) In the treatment of malaria, it is without specific value in freeing the peripheral blood from any of the phases of the development of the three recognized species of the malarial parasite; moreover, in many cases, its intravenous administration, even in 10 cc. to 15 cc. doses, causes a reaction which retards the convalescence of the patients. In larger doses, followed by more severe reactions, the results are even more unsatisfactory.

(2) In cases of septicaemia and pyelitis, due to any organism, where no other known relief measure is of value, the beneficial and curative results are spectacular in an undetermined number of cases; and the earlier it is administered in the course of the infection, the better are the results. Unfortunately, in other apparently similar clinical conditions, no benefit is derived from its use. However, in seemingly hopeless cases of infection, the intravenous administration of the drug is indicated and the patient should not be deprived of this hope of relief.

(3) In cases of illness caused by Neisser's organism, its intravenous use in simple urethritis is of no specific or curative value, but in epididymitis, arthritis, and other systemic localizations of the organism, if the drug is administered early the results are generally very satisfactory, and sometimes spectacular.

(4) Dr. de la Guardia, of the Preston Division, believes that its intravenous administration in 10 cc. to 15 cc. doses is of decided value in cases of typhoid fever showing severe toxic symptoms; though it does not have a curative action or shorten the course of the disease, it does render the patients less stuporous.

It is still a moot question as to how mercurochrome acts. The writer does not believe that its action, either locally or intravenously, is directly bactericidal;

but, in some way or other, it stimulates the defensive agents of the body to resist and overcome bacterial invasion.

In this connection, Dr. W. G. MacCallum,* in referring to "Fever," in 1920, states:

> It is common knowledge that fever is likely to accompany inflammation, and, as in the case of inflammation, the efforts of physicians and healers of all sorts have been directed toward cutting it short, on the idea that it in itself is the harmful process. Only in the last decade has it become vaguely appreciated that there is real evidence that fever, on the contrary, is a reaction elaborated to a considerable degree of perfection, which aids in the defence of the body against the advance of an injurious agent by facilitating the production of the substances which are formed in the body to neutralize poisons or kill bacteria.
>
> From this point of view it would seem, to say the least, short-sighted to give a patient in fever an antipyretic drug which will cut short the febrile reaction.

Is it not possible that the beneficial action of intravenous mercurochrome may be attributed to the reactionary fever that it produces, as well as to the direct stimulating action on the defensive mechanism of the body? We may correlate its method of action with that which results from the intravenous administration of foreign proteins,—a treatment which, in many pathological conditions, gives similarly remarkable results. In this same category it is quite probable that we may class the beneficial action which results from the treatment of cases of general paralysis of the insane, by infecting them with the tertian malaria parasites, or those of relapsing fever.

TYPHOID FEVER

Of 28,702 hospital admissions in 1926, typhoid fever was diagnosed in 124 cases, in which 24 deaths occurred, and paratyphoid in 37 cases, with 1 death. No deaths occurred in the 6 cases that occurred among employees from temperate zones. Of the 124 cases of typhoid fever, 49 were non-employees, and most of the 124 did not originate within the limits of our plantations. Dr. Nutter, of the Tela Railroad Company, states: "Only 1 of the 24 cases reported from my division originated in Tela." Most of the cases occurred sporadically, and the disease did not assume epidemic proportions in any division.

Dr. Drennan of the Santa Marta Hospital reports:

> Typhoid fever is still prevalent; especially was this true during the rainy season just passed, when it threatened epidemic tendencies, particularly during the months of September and October in the city of Santa Marta. This, I believe, can be explained by the advent of the heavy rains, at that time of the year, which drained broad areas of contaminated soil.

Owing to the rapid turnover of labor in some of the divisions, a general campaign of vaccination against typhoid is not recommended, and we are restricting this prophylactic measure to permanent employees in those districts where cases have occurred.

---

*MacCallum, W. G., "Text-book of Pathology," 2nd Edition, (p. 158)

ALASTRIM

The alastrim epidemic in Jamaica, which has been referred to in our previous Annual Reports, according to Dr. McLean has about worn itself out. A few isolated cases have been reported during the past year, but it is expected that by vaccination and re-vaccination the disease will soon be eradicated from the Island.

HOOKWORM

This infection is not of serious economic importance in our tropical divisions. Although the percentage of infection of patients admitted to the hospitals in 1926 was 38.9, as compared to 41 the previous year, the number of worms recovered, following the treatment of the individual cases, was so small that they could not be considered as having had serious debilitating effects on the hosts.

VENEREAL DISEASES

About 12.70 per cent of our hospital admissions showed evidence of being afflicted with venereal diseases (about two-thirds syphilis, and one-third Neisser's infection). This does not, by any means, represent the incidence of these diseases among our employees, as most of the cases are treated in the dispensaries, and only those suffering from serious complications requiring surgical interference are admitted to the hospitals. These diseases constitute one of the most serious problems with which we have to contend. General illiteracy of the local populations interferes with their education in regard to prophylactic measures; local customs and conventions and lack of proper facilities prevent the isolation of the infected individuals.

LOBAR PNEUMONIA

This disease is responsible for more deaths than any other single infection that concerns us in our tropical work. In 1926, 442 cases were admitted to the hospital and of these 124 died, whereas the total number of deaths from all diseases was 737.

With the exception of five persons from temperate zones, all of the cases occurred in the native and colored populations of the laboring class; and of these, 66 were non-employees. In 1925, 570 cases of lobar pneumonia were treated in the hospitals, among whom were 5 from temperate zones. Of these, 205 of the native and colored populations died, and 1 of the 5 of those from temperate zones. These conditions are characteristic of our experience of previous years. The following statements have an important relation to the racial incidence of the disease and the high percentage of mortality accompanying it:

The native and colored populations appear to have a low racial resistance to respiratory diseases in general, which include lobar pneumonia, as evidenced by the post-mortem examinations on fatal cases of this disease.

The lesions are not confined to the lungs, but pleurisy, pericarditis, meningitis, arthritis, peritonitis, etc., are very frequent findings.

Their systems seem to be unable to ward off or limit the invasion of the organisms.

Other factors, also, are concerned. Owing to the indifference and the illiteracy of these people, most of them do not seek hospital treatment until the disease is in an advanced stage.

Their natural resistance is lowered from intercurrent infections, such as malaria, syphilis, and hookworm. Anaemia, due to a variety of causes, including poor nutrition, is widely met with; and the people are indifferent in the matter of protecting their bodies with proper clothing. Periodical alcoholic dissipation is also extremely common among them.

LACTOGEN

The satisfactory results obtained from the use of this product in the artificial feeding of infants in our tropical divisions were referred to in last year's Annual Report.

During the past year its use has been extended, and the reports in general conform with those of Dr. Brosius, who states: "We have been using Lactogen, and are highly pleased with the results obtained. It is a most satisfactory substitute for mother's milk—in fact, the best I have ever used."

Attention is directed to one point of considerable practical importance: Boiled water should be used in the preparation of Lactogen, but it should be allowed to cool to a temperature of from 120° F. to 130° F. before the powder is added to it, as at these temperatures it goes readily into solution. Under the present method of marketing the powder, it appears to keep indefinitely—not requiring refrigeration, a point of considerable importance, as in some sections of the countries where we operate ice is not always obtainable.

To judge from the reports received, Lactogen seems to have solved the problem of infant feeding in the Tropics.

THE SELECTION OF LABOR RECRUITS*

WILHELM CORDES, M.D.

Preston Hospital, Cuba

The recruiting of a labor force for the Cuban cane-fields furnished an opportunity, during the year, for us to make a rapid physical examination of a large number of applicants.

Heretofore, many men were taken to the plantations who were entirely unfit for duty. Such men filled up the hospitals shortly after their arrival, and remained there as patients for a large part of the cane-cutting season.

This examination was conducted, so far as possible, when the men came to the office to register as recruits. A second inspection was made as they filed onto the dock to embark. The examinations had to be done rapidly enough to keep pace with the clerical work of registration and, as a large number of men had to be passed every day, nothing more than a brief general inspection was possible. We noted only the *general physical condition* and the *external manifestations of disease.*

Altogether, 9,171 recruits were examined and 344, or 3.8 per cent, were rejected. Following is a tabulated list showing the causes of rejection and the number of persons rejected:

	Causes of Rejection	*Number Rejected*
1.	Leg and foot ulcers	153
2.	Children (too small and under age)	54
3.	General debility and malnutrition	32
4.	Severe anaemia (cachaexia), probably including cases of tuberculosis	17
5.	Senility	15
6.	Active syphilitic or framboesial periostitis and osteitis, bone gummata	14
7.	Chancres and condylomatous or gummatous lesions of the external genitalia	12
8.	Extensive secondary syphilis or framboesia; active serpiginous lesions	10
9.	Cardio-renal disease with anasarca	8
10.	Inguinal hernia, poor operative risks	7
11.	Keratitis, iridocyclitis (almost blind in both eyes)	4
12.	Orchitis and large hydroceles	4
13.	Scabies, ulcerative and extensive	4
14.	Gangosa, active lesion	3
15.	Adenitis—inguinal, suppurative, bilateral	2
16.	Ataxia and extreme atrophy of the legs	2
17.	Crippled in both feet	2
18.	Elephantiasis—extreme, scrotal	1
	Total	344

The criterion for fitness consisted only in the examiner's judgment as to whether a man was in a satisfactory physical condition to perform his duty as a cane-cutter for five or six months, and at the same time not become a disseminator of some disease or a charge on the hospital.

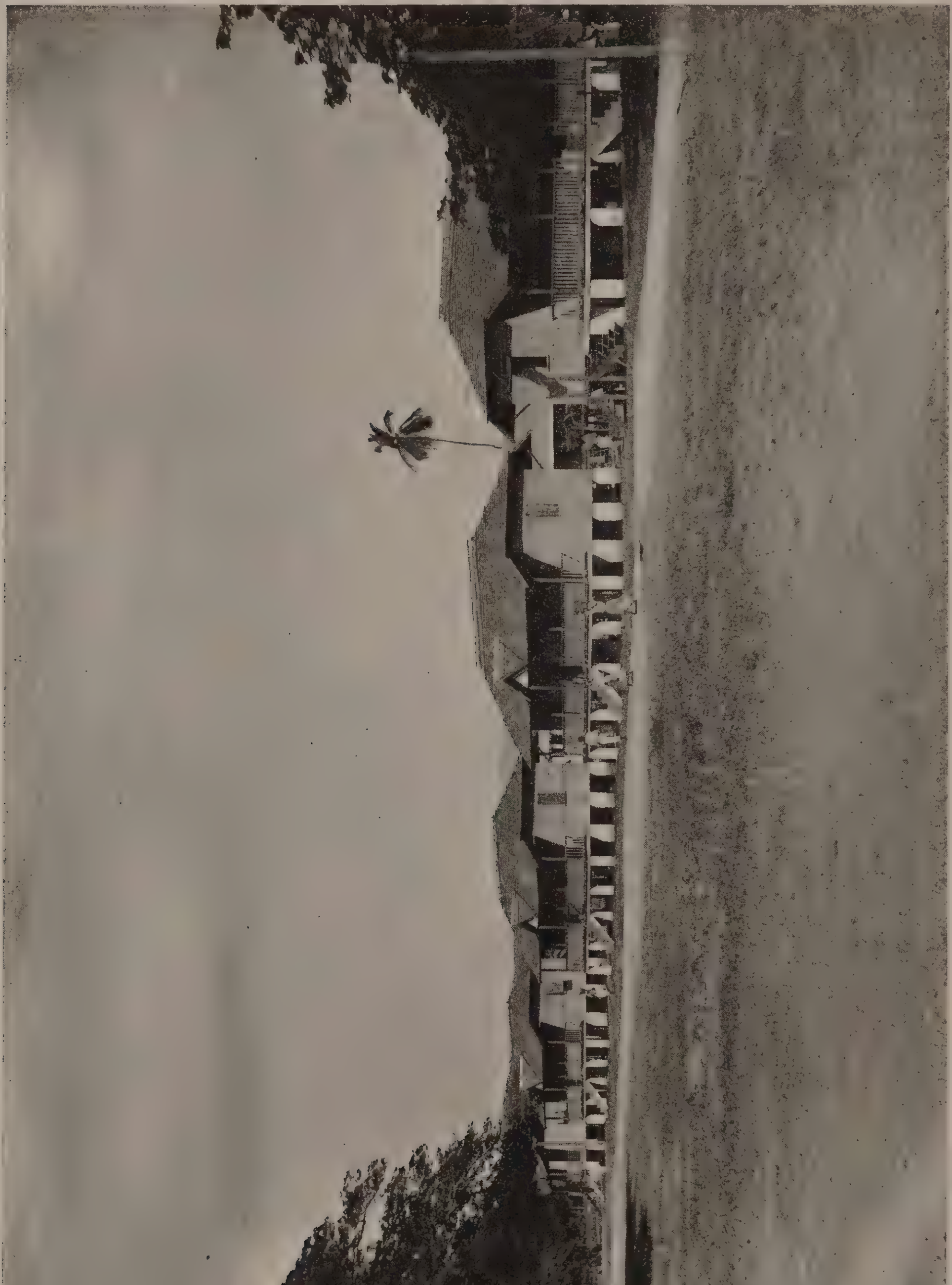
Conditions offering the hope of prompt correction by treatment and involving only a reasonable length of time in the hospital were allowed to pass—such as superficial movable leg ulcers, traumatic lesions, small reducible hernias, hydroceles of ordinary character, mutilations and deformities in consequence of badly healed fractures but with fair functional results, blindness in one eye, chronic splenomegaly of moderate degree, elephantiasis of moderate degree, scabies, and the non-infective stages of syphilis and framboesia.

It is useful to make a distinction between leg ulcers of the cutaneous type (movable ulcers) and those attached to periosteal and bone lesions (anchored ulcers). The former are less disabling and are apt to respond to treatment, while the latter may be regarded as a strict indication for rejection.

**Note.*—Undoubtedly, we shall have saved a large hospital expense for the coming year as a result of the 4 per cent rejections described by Dr. Cordes in his report; and we have also learned that many of his rejections, on returning to their homes, caused other undesirables to refrain from making an application for the cane-field occupation.

This work brings up a subject that should be given serious consideration in every one of our tropical divisions. We operate in many locations where there are no hospitals except those under our own administration, and a certain amount of charity work is therefore compulsory. We believe, on the other hand, that there are many instances of abuse. Chronic diseases that have developed in men before they entered our service have been treated for long periods of time at the Company's expense. Many suffering from such troubles get themselves placed on our pay-roll, simply to gain free hospital privileges, and with no intention of working for the Company.

We know that the introduction of a large labor force at stated intervals especially lends itself to an organized method of inspection by competent examiners. Nevertheless, we feel that a simple individual inspection by some responsible employee should be made of every laborer before he is admitted to our camps. At present, an unnecessary amount of hospital expense is entailed through the lack of just a little attention in this respect.



JAMAICA LABORERS' QUARTERS

SECTION II

SOME RECENT ADDITIONS TO OUR KNOWLEDGE CONCERNING MALARIA, AND OUR PRESENT PLAN FOR ITS CONTROL

From the standpoint of morbidity, malaria (which is preventable) is the most serious disease that concerns the inhabitants of the coastal plains of the American and some other tropical countries.

Many problems in regard to its successful control in rural communities remain still unsolved, and any advances in our knowledge that will aid us in their solution merit the commendation of the entire tropical world.

Among the more recent notable contributions on the subject is the report of the investigation of Col. S. P. James and P. G. Shute[1] covering the period of 1924–1925 and published by the League of Nations from Geneva (1926). Their observations were made during the treatment of cases of general paralysis of the insane, by infecting them with benign tertian malaria, utilizing *Anopheles maculipennis* as the vector. Although the observations made concerned only one species of malaria parasites and one species of anopheles mosquitoes, still the conclusions reached are generally applicable to, and throw a great deal of light upon, several of the many problems concerned in the control of malaria.

Since the importance of these investigations justifies an extensive reference, we are citing below the more important findings along with their accompanying complete clinical observations and the general summary of the work:

EXTRACTS FROM THE REPORT OF S. P. JAMES AND P. G. SHUTE ON STUDIES IN MALARIA

> The work provides an opportunity of studying malaria contracted in the natural way and the conditions and circumstances governing the infection of mosquitoes. . . . The mosquitoes (females of *maculipennis*) which we use are not bred from larvae but are collected in the adult stage in a country district where malaria does not occur. . . .
>
> About 2,630 female mosquitoes (*A. maculipennis*) were used in the 18 batches, but only about 530 of them ultimately were available for infecting new patients.
>
> Of these 530 mosquitoes, nearly all had sporozoites in their salivary glands when used for infecting patients. During the 24 months, 145 patients were subjected to their bites (some on more than one occasion) for the purpose of inducing malaria. Of these 145 patients, 109 developed benign tertian malaria within the usual incubation period of the disease and 36 failed to do so. . . . we make a rule to incubate the batch [of mosquitoes] at 22° C. . . . Failure to feed [the mosquitoes on blood meals] every day, or at least every other day, during the period of life in the incubator, always results in high mortality. . . . it is our practice when a batch has become "infective" to transfer it to an ice-chest at temperatures of from 4° to 6° C. The batch is then used for infecting patients. The mosquitoes which feed upon those patients are replaced for a few hours in the warm incubator at 24° C. to hasten the digestion of blood and are then put

back in the ice-chest, where they remain until another patient is to be infected. Under these conditions batches of infective insects have lived from a month to about 2½ months after sporozoites have reached the salivary glands, and certain individual mosquitoes have lived much longer. . . . [Generally speaking, mosquitoes should be fed daily for a period of one week on a "good infector" (abundant gamete carrier) to insure their infection.] . . only one of every five individual mosquitoes which suck blood from a "good infector" and are then kept for 10 days at 24° C. will survive until it can infect another person. . . . Our laboratory observations on the long life of *A. maculipennis* at low temperatures are in accordance with their known long life in nature at the same temperatures and are important in relation to the persistence of malarial infection and the manner in which, in cold climates, the malaria parasite may be carried over the winter. . . . [One of our mosquitoes] was continuously infective . . . to the date of its death (92 days). During that period it had opportunities of feeding upon patients and therefore of injecting sporozoites into them on at least 40 occasions. It successfully infected a patient by a single bite more than two and a half months after it first became infective. . . . it must be remembered that an infected mosquito often carries oöcysts at several different stages of development. They ripen and mature at different times and in consequence the salivary glands are continually being replenished with sporozoites during a considerable period. . . . we have not as yet found any inactive sporozoites in our mosquitoes. . . .

It is surprising what a small proportion of persons who suffer from malaria are infective to anopheles. . . . During this work it has been our experience that some patients with induced malaria are not at all infective to anopheles at any period of their malarial course, that others are only moderately so, and that rarely one comes across a patient who is quite strikingly infective. Mosquitoes which have only one opportunity of sucking blood from a patient in the third category become more heavily and more quickly infected than mosquitoes which feed several times on patients in the second category. We find, also, that patients in the third category retain the quality of being very infective to anopheles in second attacks and that patients who are only moderately infective in a first attack are also only moderately infective in a second attack. Therefore we are accustomed to speak of certain patients as being "good infectors" and of others as being "poor infectors." . . . On blood examination the difference between the two classes of patients is usually indicated by finding that the patient who is a "good infector" carries a large number of gametocytes, while the patient who is a "poor infector" carries only a few, but my impression is that the quality of the gametocytes (perhaps in the character of "ripeness") is also different. One reason why we do not attach so much importance to the number of gametocytes as we do to their quality is that we have had many failures to infect batches of mosquitoes when the number of gametocytes present in the patient's blood was considerably in excess of the often-quoted figure of 1 per 500 leucocytes (12 per c.mm. of blood).

In the first attacks of benign tertian malaria contracted by the bites of mosquitoes we have never found gametocytes in thin films of blood taken before the seventh day after the first rise of temperature; and early dissections show that the gametocytes are not infective to anopheles until about three days later. In relapses, however, gametocytes can be found much earlier—usually, indeed, on the first day on which the occurrence of the relapse is reported. Also they can be found earlier in first attacks of malaria induced by direct-blood inoculation than in first attacks induced in the natural way.

There are great differences in the number of gametocytes found in the peripheral blood of different cases and considerable differences in the number present in the blood of the same patient from day to day. The numbers in the blood of three patients on whom we fed successful batches of mosquitoes rose from a minimum of 10 to a maximum of 70 per 500 leucocytes in the first patient, from 7 to 700 in the second and from 10 to 120 in the third. The number rises rapidly at the beginning of the second week of the malarial attack and sometimes falls during the third week. There are usually fewer male than female gametocytes in the peripheral blood; as regards the three instances referred to above, the first patient had, on an average among each 100 gametocytes, 35 males and 65 females; the second 23 males and 77 females; the third 43 males and 57 females. . . .

I do not think that the English *A. maculipennis* becomes infected as readily as some tropical species of anopheles. . . . As a result of many trials we have come to believe that mosquitoes which at first seem refractory to infection can be forced, so to speak, to become infected by repeated feeding on a suitable case. We think that this plan of repeated feeding added to the selection of suitable cases on which to feed have been the chief factors in our successful results.

The earliest day on which we have found sporozoites in the salivary glands of some individual mosquitoes in a batch has been the tenth day after the first feed on the infective patient. This refers to batches incubated at 24° C. in a saturated atmosphere. After sporozoites are found in the glands we usually wait a further day or two days before beginning to use the batch for infecting patients. . . . when the eggs of *A. maculipennis* are coming to maturity, we have observed an interesting condition which cannot fail to have some influence on the infection of the individual mosquitoes to which it applies. At this period the swollen ovaries fill the abdomen and press against the midgut of the mosquito to such a degree that its cavity is almost obliterated. Females in this condition do not refuse to suck blood, but the blood, instead of passing into the midgut, fills and distends the oesophageal diverticula. Examining such a female after it has fed, one sees that there is red blood in the abdomen and one concludes that the insect, having fed on the infective patient, will itself become infected. On dissection, however, one finds the midgut quite empty of blood and the oesophageal diverticula distended like small red bladders. From time to time a little of the blood oozes from the diverticula into the midgut, but not in sufficient quantity to ensure the infection of the insect. In the same connection another point of importance is that mosquitoes carrying nearly ripe eggs do not suck nearly so much blood as do mosquitoes with undeveloped ovaries. This is doubtless due to the pressure of the swollen ovaries on the midgut just mentioned. In contrast to this habit (and in consequence of it) mosquitoes which have just laid their eggs (and have survived the egg-laying process) always feed at once and greedily until the midgut becomes distended with blood. Indeed, these individuals are so hungry that they will usually bite in the open air if they happen to find a person on the bank of the pond on which they have just laid their eggs. It has occurred to us that this observation (which we have made on more than one occasion) affords a reasonable explanation of the rare occurrences in which persons become infected with malaria while resting or sleeping in the open air near anopheles pools or marshes. An "infective" mosquito (*maculipennis*) which has not ventured beyond a house or stable up to the time when its eggs become ripe must make a flight for egg-laying at this time. We conclude from our observations that, if it reaches a breeding-place and survives the egg-laying process, its next act will be to bite and suck blood from anyone who happens to be near it. In doing so it injects into him the sporozoites which its salivary glands contained before it left the house in which it became infective.

Reference has already been made to the unfavourable effect of permitting mosquitoes which are being infected to have any other kind of food than fresh blood. It is possible that when a mosquito feeds on certain fruits the chemical reaction of the stomach is not entirely favourable to oöcyst development. After several feeds on human blood and omission of other kinds of food, the stomach becomes a more favourable medium. The only remaining factor to which we propose to refer is that of chance. Undoubtedly this factor enters largely into the problem of how many oöcysts will result from one or more feeds. Among every batch of mosquitoes, some feed greedily, some lightly, some not at all. Some of them also evacuate a considerable proportion of the sucked blood while they are in the act of feeding. The fertilised gametes (travelling vermicules or oökinetes) which are in the middle of the mass of blood in the mosquito's stomach have less chance of reaching the internal coat of the stomach than those which are in the layer of blood that bathes the wall. Indeed, it has sometimes seemed to us that the only oökinetes which succeed in penetrating the endothelial layer of the stomach lining and which therefore succeed in becoming encysted are those which happen to be actually in contact with that layer at the time when they were fertilised. . . .

"Susceptibility," "immunity," "tolerance to the effects of the parasite invasion," "individual resistance," etc. are debatable subjects on which as yet our observations do not throw as much light as I hoped they might do. . . . During this work we have learned that when an inoculated patient fails to develop malaria, the cause must be sought first on technical rather than biological grounds. I think it justifiable to say that technical reasons for failure of inoculations or reinoculations have not been sufficiently examined by the many writers who, after a short or a long experience of the direct-blood method of inducing malaria, have added something to the literature of malarial "immunity." . . . we are more cautious in attributing failure to biological conditions. The same caution must be exercised in explaining apparent failures to infect or to re-infect human beings. . . .

[There have been] rather striking results of the infection of patients who were reported as being "immune" after one or more successful inoculations, usually by the direct-blood method: . . .

Conclusions drawn from these observations are: (a) several fresh infections, at intervals, by the direct-blood method with one strain of *P. vivax* do not confer immunity against mosquito infection with another *vivax* strain; (b) one attack (induced either by blood inoculation or by mosquito bites) does not confer immunity against a second infection with the same strain of *P. vivax*, . . . It is clear that the difference between the temperature charts of the [first and second attacks] indicates that a striking change in the patient's reaction to malarial infection has occurred; his blood or tissues have acquired some quality which previously they did not possess. But we are not justified in assuming that the new quality indicates the presence of "immune bodies." Nor can we assume that the few patients who react to a primary infection in the manner in which the great majority of patients react to a second infection are naturally possessed of these "immune bodies." It may be that a simpler process is at work. We know that the malaria parasite thrives and multiplies better in the blood of some individuals than in that of others. . . . some individuals . . . are very "susceptible" to malarial infection [and others] are relatively "resistant" or "refractory" to infection.

CLINICAL OBSERVATIONS

The discovery that in some respects the classical description of benign tertian malaria cannot stand is one of the most striking results of a study of the induced disease. Our observations suggest that the following are among the chief points which merit consideration in framing a new description of the disease:

1. In a primary attack of untreated benign tertian malaria three stages can be recognised; they may be termed, respectively, the initial stage, the developed stage, and the terminal stage.

2. The initial stage ordinarily lasts from two to five days. It begins as a gradually increasing irregular fever. At first the fever is subcontinuous or irregularly remittent, but towards the end of the stage it is always intermittent. There are no "rigors" during this stage. Its termination is sometimes shown by an intermission lasting 24 or 48 hours.

3. In the developed stage a primary benign tertian malaria in 80 per cent of cases is not a tertian fever but is a quotidian fever. There is a "rigor" every day. This is true whether the patient has been infected by only one bite of one mosquito on a single occasion or whether he has been infected by the bites of many mosquitoes on several different dates during the incubation period of the disease. The stage of quotidian fever often lasts more than ten days.

4. The terminal stage is characterised by the fever changing from quotidian to tertian type. It is sometimes characterised also by a steadily diminishing severity of the fever attacks until, after some days, they fail to occur (so-called "spontaneous recovery").

5. In 10 per cent of cases a primary attack of benign tertian malaria is a tertian fever throughout its course, and in about the same proportion of cases it is a tertian fever which soon changes into a quotidian fever. When a primary attack runs a clear tertian course from the beginning it is always advisable to enquire into the past history of the patient with a view to ascertain whether he has previously had malaria.

6. By examination of the peripheral blood in a primary attack it is seldom or never easy to correlate the course of the temperature with the stages of growth of the parasite; the temperature chart shows a sharp febrile attack recurring regularly every day, but blood examination shows parasites in nearly all stages of development. In cases infected by only one bite of one mosquito the first parasites that can be found in the peripheral blood are all at the same stage of growth. But even on the second or third day following the first positive finding, parasites in several stages of growth are found; and this condition persists beyond the initial stage of the disease into, and sometimes almost throughout, the developed stage. It is curious and puzzling that a patient who has been infected with a pure strain of *P. vivax* by only one mosquito bite on only one occasion nearly always shows a quotidian type of fever in the developed stage of the attack and that groups of parasites in different stages of growth are always found. The quotidian type of fever does not mean that the parasites complete their asexual cycle in 24 hours instead of in 48 hours. There is no reason to assume that the fundamental 48-hour cycle of the benign tertian parasite does not hold good. Indeed, we believe that we have been able to demonstrate the 48-hour cycle of the parasite from the earliest date of a positive blood examination. But we find that when films are taken frequently throughout the period of the first febrile paroxysm which is characterised by a "rigor," it can be seen that some of the sporulating parasites are not quite so far advanced in their development as others; their growth has been a little slower than that of most of the parasites and therefore their "sporulation" occurs half an hour or an hour later than that of the bulk of the parasites. For example, at 10 A.M. one may find that the bulk of the parasites are "sporulating" but that a few are still in the "pre-sporulating" stage, and at 10.50 one may find that the bulk of the parasites are in the form of very tiny rings, which have just entered the corpuscles, but that a few are still only beginning to sporulate. The result of this relatively slower development of some parasites is that, after one or two febrile paroxysms, the blood picture, which at the first positive examination showed parasites in only one stage of growth, now shows parasites in two or even three stages. The irregularly remittent temperature characteristic of the initial stage of a primary attack is probably the clinical expression of these different

groups of parasites sporulating at different times. Later, the two groups whose difference of growth is greatest (very young rings as compared with full-grown forms) usually become dominant and determine the character of the fever as a fever with a daily paroxysm. It can be seen on most temperature charts of a primary attack that the height of the fever on every other day is nearly equal, and that it is always higher, say, on the 1st and 3rd, than it is on the 2nd and 4th. This is the clinical expression of the two dominant groups of parasites. Lastly, because the tendency in benign tertian malaria is towards recovery and disappearance of parasites from the peripheral blood, the group of parasites which is least numerous naturally disappears first. The result is that towards the end of the developed stage of the malarial attack only one group of parasites is left and the temperature chart then shows true tertian periodicity. Later, two groups may again be found, but as a rule the chart retains its tertian character.

7. A second attack resulting from a new infection by mosquito bites shows a clinical picture quite different from a primary attack. Even when a long interval (in our experience five months) has elapsed between the first and second infection, the second attack has the appearance of beginning with the terminal stage of the first attack—that is, with a true tertian periodicity. There is little or no initial stage, and no stage of quotidian fever precedes the stage of tertian fever. But the parasite findings resemble closely those of a primary attack. On the first positive examination only one group of parasites may be found, but a day or two later parasites of two or three stages of development will be found at every examination. The temperature chart, however, continues its true tertian character as if reflecting only that group of parasites which is most numerous. After four or five typical tertian paroxysms it may happen that a second group of parasites becomes reflected in the temperature chart, which then changes from tertian to quotidian type.

8. A relapse usually has the clinical characters of a second attack, but the parasite findings differ in that gametocytes can be found earlier than in a fresh infection. For the treatment of general paralysis and other mental diseases the opinion is sometimes held that a "rigor" every other day is preferable to a "rigor" every day. We find that the desired change from quotidian to tertian type can usually be effected by allowing the primary attack to run for four or five days, then stopping it temporarily by one dose of from 3 to 5 grains (0.2 to 0.3 gramme) of quinine and then waiting for a relapse. The relapse almost always will be a true tertian fever.

9. As would be expected, there are certain individuals in whom the course of the disease does not follow the general pattern outlined above. We have already referred to this matter in the preceding section on susceptibility and immunity.

10. Up to the present I have not been able to come to a definite conclusion as to whether the duration of the incubation period of an attack or the severity of the attack is influenced significantly by the amount of the infective dose. This is surprising in view of accepted opinion on the cause of the severity of war malaria, as well as in view of experiments with proteosma infection of birds. The purpose of the tests which I considered it necessary to make on this subject was to ascertain how best to induce the series of high temperatures on alternate days which are most efficacious for the treatment of general paralysis. Our patients are in the following four groups: (a) those infected by the bite of one mosquito on a single occasion; (b) those infected by the bites of several mosquitoes (three to ten) on a single occasion; (c) those infected by the bites of many mosquitoes (up to 120) on a single occasion; (d) those infected by the bites of several or many mosquitoes on different dates during the incubation period of the disease. It is true, of course, that even one heavily infected mosquito injects more sporozoites than many scantily infected ones, but the results which

I have in mind in this connection are based on instances in which all the mosquitoes used were well infected. The difficulty of arriving at a definite conclusion on the subject is due to the fact that different individuals among the particular class of patients with whom we are concerned react very differently to malarial infection. Possibly, as I have already mentioned, it would not be justifiable to assume that similar results would be obtained among members of a healthier class of the general population. A patient who has been infected by the bites of say 60, 80 and 30 mosquitoes respectively on three occasions between August 29th and September 5th may have only a relatively mild attack with temperatures between 103° and 104° F. and a moderate parasite invasion, while another patient who has been infected by only one bite of one mosquito of the same batch may have a severe attack with temperatures between 105° and 106° F. and a parasite invasion which has to be stopped by quinine on the fifth or sixth day. As regards duration of the incubation period we have examples of periods as short as seven and eight days in patients bitten by three and by ten mosquitoes respectively, as compared with examples of periods as long as 18 days and 17 days in patients bitten by 60 and 120 mosquitoes respectively. Therefore it is not easy to state any general rule such as has been stated by observers who have worked on the subject in relation to proteosma infection of birds. Our observations demonstrate again the importance of the qualities possessed by the blood and tissues of the individual concerned. Nevertheless, we have ascertained in a few cases that a large dose results in a greater parasite invasion of blood corpuscles than a small dose and that a second infection at an interval of between eight and twelve days after the first can be detected by an increase in the number of parasites following the expected date of onset of an attack due to the second infection. But we do not find any significant indication of the second infection in the temperature chart; it continues to show only the single daily rise of temperature which was due to the first infection, and the height of the fever at each paroxysm is not appreciably changed. Nor have we observed up to the present that relapses are more frequent among patients infected by a large dose or on several occasions than among patients infected by a smaller dose or on only one occasion. We hope, of course, that with an increase in the number of our observations, we shall be able to report more definitely on these points.

11. The incubation period of the naturally contracted disease, according to our records, is most frequently twelve days, but there are nearly as many cases in which the period is ten days. Ninety per cent of all our cases commenced to have fever before the 17th day after infection and nearly 70 per cent between the 10th and 15th days. The shortest incubation period was seven days, the longest twenty-three days. Unless special arrangements are made to ensure that the temperature will be taken every four hours from about the tenth day it often happens that the initial febrile manifestations of the attack are missed. As a rule we have not found parasites in the peripheral blood until the second or third day after the first rise of temperature.

SUMMARY

1. An important result of our observations is that they indicate how small is the chance that a particular brood of malaria-carrying mosquitoes in nature will ever be concerned in transmitting the disease. It is probable that at least 95 per cent of the potential malaria-carrying mosquitoes which emerge from the larval stage in nature will never play that role, which is reserved for a few individuals whose life will be passed in a manner very different from that of the remainder of the brood. This conclusion is forced upon us when we consider how difficult it is, under the most favourable conditions, to bring even a few members of a large brood of mosquitoes to a condition in which they will

be successful transmitters of malaria. Our report is largely concerned with the difficulties of this task, and it is certain that, in the rougher conditions of nature, no mosquito which does not overcome equal or greater difficulties will ever be a transmitter of the disease. Mosquitoes under favourable laboratory conditions lead a sheltered life. They are protected against wind and rain and against unfavourable changes of temperature; the food upon which they thrive best and live longest is available without effort or risk, and care is taken to prevent the ingestion of a diet which is unsuitable or is contaminated with bacteria or moulds; when a mosquito refuses a meal it is separated from the rest of the batch and nursed at a lower temperature until it will feed. In nature, special conditions of this kind cannot often be available, but I do not hesitate to affirm that in nature the only mosquitoes which succeed in transmitting malaria are those rare individuals who happen to pass their life in conditions which resemble very closely those which we have found to be essential for the successful transmission of the disease in experimental work. No one who fully appreciates the importance of this conclusion and accepts it as true can fail to regard anti-mosquito measures for dealing with malaria from a new point of view. He will at least realise what a great waste of effort is involved in measures directed against the breeding-places of mosquitoes as a whole, and even in similar measures directed against one species. He will begin to appreciate how the secret of a successful control of malaria lies not in the general knowledge that the disease is spread by mosquitoes of a certain kind, but in the particular and exact knowledge of the life history of the few individual mosquitoes which succeed in becoming transmitters of the disease.

2. A second important result of our observations is that even among the relatively few anopheles which come to rest in a place which is favourable to their infection not many will ultimately become infective. In this connection one of our observations is that the presence of oöcysts in a mosquito's stomach does not inevitably mean that the salivary glands will become infected, for we believe that in some individual insects young oöcysts fail to come to maturity and disappear even when the insect lives long enough for their full development. For this reason we have noted that reports of feeding experiments which are discontinued before sporozoites are found in the glands are misleading. Other observations on this subject to which attention has been drawn in the report are: (1) the rarity of patients who are good infectors of anopheles; (2) the fact that a patient in a primary attack is not infectious until ten days have elapsed from the beginning of his illness (by which time he should have been treated with quinine); (3) that, except in the rare instances of patients who are unusually good infectors of anopheles, the mosquito must feed several times on a patient in order to become infective; (4) that when the temperature is sufficiently high for the development of the parasites, the mosquitoes which harbour them must have an opportunity of feeding every day; (5) that when the insects feed on certain fruit, as well as on blood, the probability that they will become transmitters of malaria is much reduced; (6) that there are certain physiological factors and "chance" factors which interfere with infection, such as the growth of the ovaries preventing the infectious meal of blood from entering the midgut of the mosquito, the loss of gametes by quick evacuation of the blood meal, and the situation of the fertilised oökinetes in the mass of undigested blood in the mosquito's stomach.

Having regard to all these circumstances, and also to the factors of temperature and humidity, we must certainly regard malaria as a disease which does not spread unless a large number of special conditions are fulfilled. Our observations on these conditions help to explain why it is the general rule to find only a low percentage of infected anopheles in nature and why malaria in nature is seldom or never contracted except in certain houses or shelters where the above circumstances and conditions pertain. They fortify the opinion that malaria is essentially a household disease and particularly a disease of certain kinds of houses that fulfil the "laboratory conditions" which we have described. The reasonable inference is that malaria should be dealt with in the houses of the people rather than in the environment.

3. Since it is the case that in nature only a few anopheles become transmitters of malaria, it may well be asked how it comes about that in many places all the inhabitants are infected with the disease. The answer is certainly given by the observation that a mosquito which has succeeded in becoming infective retains its infecting power for a long period and can infect many people. Different batches of our mosquitoes lived and continued to be infective for periods ranging from one month to three months after the date on which sporozoites were present in their salivary glands. Some of the mosquitoes in these batches, after biting between 30 and 40 patients, still had numerous sporozoites in their glands. This was because the glands were replenished from time to time with sporozoites from oöcysts which ripened and ruptured at different times. In nature, a mosquito which has made its home in a house containing several malarious children who are untreated has frequent opportunities of becoming freshly infected; the result is that its stomach carries oöcysts in many stages of growth and its salivary glands are restocked with sporozoites from time to time throughout the remainder of its life. . . .

4. The observations which we record relative to the resistance of oöcysts and sporozoites to cold, coupled with the observations on persistence of infectivity just mentioned, lead to the conclusion that benign tertian malaria can be carried through even a severe winter in hibernating mosquitoes. This persistence of infectivity through the winter explains some of the occurrences in Northern Europe of primary attacks of malaria during that season and in early spring.

5. On the subject of the infection of patients by the bites of mosquitoes, an interesting result in relation to the malaria problem in nature is the failure of some of our patients who were bitten during the winter to develop malaria. This came as a surprise, because throughout the summer there had been no failure. For reasons stated in the report I am not prepared as yet to prove that the failures were not due to insufficiency of the infective dose. Therefore I prefer to postpone discussion of them until a later date. If any patient who has not yet developed malaria as a result of mosquito bites in November or December should develop an attack in the spring we shall know that the infection has remained latent in him throughout the winter. Many examples of this "long latency" are recorded in the literature of malaria in nature, but up to the present the matter has not been proved by laboratory work. As yet the longest incubation period which we can record is 23 days. Therefore we cannot yet add anything of value to existing explanations of the peculiar seasonal curve of primary malarial incidence in Northern Europe, except, of course, the observation recorded in paragraph 4 above.

6. We find that one attack of benign tertian malaria does not make a patient refractory to a second attack, though there is usually a striking difference between the clinical type of fever in the two cases. This difference suggests that as a result of an attack a patient acquires some quality which he did not previously possess, but the quality is not necessarily that of possessing "immune bodies." For various reasons it seems worthy of enquiry whether some of the differences of "susceptibility" and of "resistance" to malarial infection among different individuals may be due to a relatively simple cause such as a slight modification of the normal chemical reaction of the blood or a change in its content of lecithin and other proteins.

> 7. Among clinical observations it is pointed out that in some respects the classical description of benign tertian malaria cannot stand, and some of the points which merit consideration in framing a new description of the disease are noted. No definite conclusion is reached as to whether the severity of an attack is influenced significantly by the amount of the infective dose injected by mosquitoes.

In view of the fact that James[1] lays great stress on his opinion that malaria is essentially a "household disease" and that it should be dealt with in the houses of the people rather than in the environment (anti-larval methods), one is forced to recall the advice of Le Prince[2] in this respect. "Systematic mosquito catching in dwellings, as a prophylatic measure against malaria, originated in the Canal Zone." . . . "It was first tried in 1908 by W. R. Proctor, sanitary inspector, in a temporary camp known as Cocoli," and later in the same year at Diablo Hill. During 1909 a further satisfactory application of the method was made in a number of isolated camps along the line of the Panama Railroad relocation.

This method has since been employed by Le Prince[3] in selected rural districts of the southern United States and his report in 1926 is worth referring to. He states that in the farm-tenant homes of the poorer class, where the family has insufficient funds to protect themselves from malaria by making the home mosquito proof, it is known that a considerable reduction in malaria transmission can be accomplished by systematically destroying the *anopheles* that are to be found each morning resting on the walls of the bed-rooms. This is effective where no attempt has been made to screen the building. He further remarks that after many species of Anopheles become engorged, they rest on the wall or other suitable shaded resting place relatively close to where they obtained their blood meal. Those which have digested their blood meals and are ready for flight, depart from their daytime resting place (house or inclosure) either soon after dusk or soon after daylight. In screened buildings the *Anopheles* ready to depart collect on the window and door screens during these periods, and with a little care practically all of them can be destroyed. The common fly-swatter will be found of practical use for this purpose.

We believe that insecticide sprays should prove useful in this work.

The Medical Department of our Company has completed a survey of all tropical divisions during the year, in order to determine the incidence of malaria. This work has brought to light some important facts concerning the incidence of gametocytes. One of our staff has published a report on this subject which we believe should be reproduced here, since it has an important bearing on some of the features discussed by James. We quote from Dr. Clark's[4] preliminary article on the comparative incidence of gametocytes in untreated and in briefly treated cases of malaria:

> *Time.* These examinations were conducted in the year 1926 during the months of April to September, inclusive.
>
> *Terrain.* Some valleys near the coast in the tropical and subtropical regions of the Caribbean littoral, and some adjacent islands.

Rainfall. All the surveys, relatively speaking, were made in the *dry season* or at the beginning of the rainy season.

Races. Nearly all of the people examined belong to two races, namely, Latin Americans and West Indian negroes.

Methods employed. Representative groups of the inhabitants were taken from the port towns, intermediate settlements, and as far out as the most remote camp in certain valleys. The port towns and other villages were usually represented by the school children available and a sample from the edge of some of the towns where anopheline breeding foci were found.

Rather more than half of the labor class examined consisted of men who were found off duty in their camps.

The writer personally collected, prepared and examined the blood films.

One thick blood film (5 small drops) was made from each person. The Barber and Komp[5] thick film technique was employed and a freshly prepared stock of Giemsa's stain was used. The average time spent in examining a slide was one minute.

Class of hospital cases examined. At the close of the field survey in each location, the writer examined by the same method each available hospital case that was ready for discharge after treatment for malaria. The period of treatment for the group examined averaged about seven days.

Results of the field surveys. The samples of the populations examined total 7,201, and of this number 2,151 were found positive for malaria (29.8 per cent).

The village index was 19.7 per cent.

The labor index, exclusively, was 41.1 per cent.

I am sure that these indices would have been greater if the examinations had been conducted after the *rainy season* was well established.

Anophelism was marked in most of the regions examined, and *A. albimanus* was everywhere the predominant species.

It has already been stated that rather more than half of the labor examined represented men who were found off duty in the labor camps. It may be of interest to know that almost 3 of these men were positive for malaria to 1 that was found positive among those examined who were at work. The heavily infected cases were, nearly always, among those men who were found off duty in the camps. Even though many of these men did not complain of illness, it could be seen from the survey results that the disease more or less naturally segregated those individuals who needed attention.

Species of plasmodia found in field survey

	Per Cent
Aestivo-autumnal	76.6
Tertian	18.0
Quartan	2.5
Mixed infections	2.7

Daily examinations of these people over a short period of time would have certainly increased the rate of mixed infections.

In spite of the fact that practically all of the "positives" found in this survey were ambulatory cases of malarial fever, it is true that 23.9 per cent of these positive people had a degree of malarial infection that was just as rich in parasite abundance as any case under treatment in the hospitals.

The majority of the "apparent idlers about camp" were men who needed treatment. Such men often delay treatment for days, and even weeks, before they either recover spontaneously or become hospital and dispensary cases. The labor lost by this condition is of considerable economic importance.

Gamete rate in field surveys. This examination yielded 13.5 per cent (chiefly crescents) and it is a somewhat higher rate than I have been in the habit of finding in other surveys where the same method of examination was in use. People carrying abundant gametes were seldom found.

Gamete rate in treated cases. A series of 124 cases were examined from 8 hospitals, and 57 of them were positive for parasites, usually gametes (crescents). This yields a rate of 45.9 per cent.

This small hospital series of 124 people, as compared with the field series of 7,201 people, makes an accurate comparison by rates somewhat difficult, yet the fact that 57 of the cases were found positive (after the hospitals had instituted intensive quinine treatment for a week) seems astonishing. These hospitals use a good quinine product and administer from 30 to 45 grains daily until the temperature becomes normal. The cases at the time of their discharge from the hospital were without fever and symptoms, and were anxious to return to their camps where, unfortunately, the follow-up treatment prescribed is seldom adhered to.

The few opinions that have been offered me on this subject are not in agreement as to *whether gametocytes found under these circumstances are infective to the mosquito.* If they are infective to the mosquitoes, as seems reasonable to believe after Wenyon's[6] experimental proof in Macedonia, then recently discharged hospital cases of (particularly) aestivo-autumnal malaria are for weeks a greater menace in the labor camps than the usual untreated case that one finds in field surveys. I have been able to follow 2 hospital cases of severe aestivo-autumnal malaria over a period of treatment lasting 25 days. The symptoms and fever disappeared in about one week, but every daily thick film during the entire stay was positive for crescents in considerable number.

Another case, under treatment for aestivo-autumnal malaria as well as for a chronic surgical condition, was under hospital observation for almost two months. His blood film was not examined daily, but on the 54th day his thick film was positive for crescents.

In regard to some of the opinions concerning crescent development and persistence under treatment, it is interesting to review Marchiafava and Bignami[7] who write as follows:

"If the infection has lasted several days, the appearance or the increase in number of the crescent forms will correspond to the diminution in number of the young endoglobular bodies. The salts of quinine, even when given in doses as large as 2 gm. a day, do not perceptibly affect the crescent forms of these parasites. Quinine acts upon the malarial parasites in that phase of their life in which they are nourished and develop. When the nutritive activities cease by an arrest of the transformation of hemoglobin into black pigment, and the reproductive phase begins, then quinine is ineffectual in its action."

Seguin[8] believes that gametes do not appear for ten (usually not for twenty or thirty) days after infection and that if treatment is not instituted before gametes appear, the course of treatment must extend over a period of thirty to sixty days if the gametes are to be destroyed.

Ovazza,[9] writing recently on the permanence of malarial gametes, states that they have persisted in the circulation, in 54 cases examined by him, for from 7 to 55 days. The incidence of gamete carriers among positives found by field surveys recently conducted by others indicates in Algeria[10] a rate of 10.9 to 17.3 per cent.

Van Hoof,[11] in another old world area, reports 17 to 19 per cent.

Craig[12] believes, from his own observations, that from 40 to 50 per cent of the latent cases of malaria have gametes in their blood. It has not been my experience to find, in a single thick blood film examination of a community, as high a rate of gamete carriers as Craig indicates, but it is conceivable that a daily examination over a short period of time would greatly increase the field rate shown in my survey. On the other hand, I am quite sure that a similar method

> of examination conducted on the malaria cases discharged from the hospitals would show not only a very much higher incidence of gamete carriers, but also a greater abundance of gametes. I am of the opinion that this fact alone warrants an intensive short-radius campaign of anopheline larva control about labor camp sites. The few breeding foci in the immediate neighborhood become a greater menace than the larger remote breeding foci.
>
> This series of field surveys indicates that a large number of infected laborers naturally eliminate themselves from the working forces and become "apparent idlers about camp" for long periods of time before treatment is started. It is also indicated that daily inspections of rural camps should be made and camp treatment instituted in the early stage of the illness, as well as a follow-up treatment for the cases discharged from a hospital.
>
> *It is my belief that the degree and promptness of gamete invasion of the peripheral blood stream following a brief, vigorous use of quinine in aestivo-autumnal malarial fever is not very generally known, and that the long period over which many treated cases show a persistence of gametes in the peripheral blood is also not widely understood.*
>
> These are very important facts to be kept in mind by those of us who are attempting to control malaria in the Tropics.

We have discussed with others who are interested in the control of the disease the high rate of crescent carriers in our briefly treated hospital cases of malaria. Most of the opinions offered us were to the effect that such cases carry unripe gametes and that these young crescents in a cinchonized blood would probably not be infective to the mosquito. This led us to arrange plans to investigate the subject, by means of a series of biting experiments. Most of the biting experiments on record appear to have been performed in Europe and the United States, using the anopheline vectors common to those countries and, generally, the tertian species of the malarial parasites. In approaching the study of the problem, we have made a more complete survey of the literature, with the result that we have found a few very good reports on this subject. We will quote them in the order of time in which they have been reported:

F. Loeffler[13] (1905), quoting Gualdi and Martirano, expressed a fear of mosquito infectibility by gamete carriers who are still under quinine treatment.

Darling[14] (1909) records the following:

> In tertian malarial fever there is never an abundance of gametes in the peripheral blood after the disappearance of the sexual forms, such as is seen in estivo-autumnal infections; besides, all forms of the tertian parasite disappear from the peripheral blood within two or three days under quinine treatment, and occasionally disappear when quinine is withheld.
>
> A curious relationship was observed between the average number of days that gametes remained in the blood in estivo-autumnal and tertian infections when under quinine treatment (the number being about 10 in estivo-autumnal and 3 in tertian) and the average proportion of the incidence of estivo-autumnal and tertian malarial fever in the Canal Zone. This might be interpreted as indicating that the proportion of cases of estivo-autumnal to tertian malaria depends on the number of days that gametes are in the peripheral blood in sufficient numbers to infect *A. albimanus*, which is the host for both forms of the parasite.
>
> The infection of *A. albimanus* and the development of malarial parasites in her midgut is not interfered with by quinine when such an infected mosquito feeds

> daily or on alternate days for 15 days on patients who are receiving 30 grains of quinine in solution daily. In these instances the zygotes mature and sporozoites reach the salivary glands in the usual period.

Ross[15] (1910) writes as follows:

> An important point in connection with the prevention of malaria is that Bignami and Bastianelli, Gualdi and Martirano, and Schaudinn have succeeded in infecting Anophelines from patients who had been taking quinine. Schaudinn's case had been taking 1 gram thrice a week. Ziemann regards this as indicative that the male gametes are not destroyed as he thought. It also suggests that cases with crescents are likely to prove sources of infection in spite of energetic treatment.

Barber[16] (1918) has indicated in his mosquito infectivity experiments that quinine apparently has little effect on gametocytes other than to increase the rate of their disappearance. In numerous trials this worker has shown that human carriers are capable of infecting mosquitoes when quinine is administered in curative doses.

Wenyon[6] (1921) makes the following statement:

> The deduction is that cases of *P. vivax* infection taking quinine, even though gametocytes are present in the blood, are unlikely to infect mosquitoes. In the case of *P. falciparum* the result was very different, for of 40 *A. maculipennis* and 37 *A. superpictus* fed on cases taking quinine, 30 of the former and 26 of the latter became infected. It seems that quinine has a much more marked effect on gametocytes of *P. vivax* than on those of *P. falciparum.* In the case of the *P. vivax* experiments each mosquito was fed on many more cases than in *P. falciparum,* so that the chances of their becoming infected were greater.

These researches appear to solve the problem we were preparing to investigate, for they include work with the gametes of *P. falciparum* in cases under treatment with quinine, and also the use (Darling's experiments) of *A. albimanus*, our most important vector.

PLASMOCHIN

Plasmochin (plasmoquine), the recent discovery of German scientists, will offer us, we hope, a new weapon to be used against the crescent carrier. A year ago there were rumors abroad that a new drug would soon be available for this purpose, and at present it is being heralded as a most effective remedy in the treatment of malaria. Considerable time elapsed before we were able to secure enough of the drug to form an opinion in regard to its value. We are grateful to Prof. P. Mühlens, Director of the Clinical Division of the Tropical Institute, Hamburg, Germany, and to the Winthrop Chemical Company, Inc., New York City (American representatives of the German manufacturers), for supplying us with enough of the drug to give it a trial in some of our tropical divisions.

Since there has not been sufficient time for the remedy to become well known, we present the following information from the "*Summary of Results with 'Plasmochin' in Malaria*"[17]:

Plasmochin is a synthetic quinolin derivative which, as available results of investigators prove, is effective in human malaria. As compared with quinin, the following distinctions have been noted:

Tertian and Quartan Malaria:

In doses of 0.02 gm., 3, 4 or 5 times a day, by mouth, Plasmochin is about as rapidly effective as quinin in daily amount of 1 gm. Defervescence occurs on the second or third day of medication. The parasites disappear from the peripheral blood. Relapses seem to be less frequent than after quinin therapy (statistics, however, are not adequately extensive). Plasmochin is more toxic than quinin; even with doses of 0.02 gm. five times a day (a total of 0.1 gm. Plasmochin), cyanosis may develop now and then, which disappears in a few days after discontinuing the treatment without any persistent disturbance. It is impossible to foretell what patients may have a tendency to cyanosis as this has been observed in debilitated as well as in robust persons; on the other hand, debilitated patients often show excellent tolerance to Plasmochin. Rigid clinical observation is therefore essential.

Tropical Malaria:

In the aforesaid doses Plasmochin works about as rapidly as quinin. In many cases of tropical malaria, Plasmochin alone will cause the disappearance of fever and parasites. Sometimes defervescence occurs later (third to fifth day). Hence, treatment with Plasmochin alone taxes inordinately the strength of the patient. Furthermore, relapses may develop in a short time. The advantage of Plasmochin in tropical malaria is the possibility of destroying the gametes (crescents) in five to seven days, which is not possible with quinin. Hence, Plasmochin is rated as a definite gameticidal agent in tropical malaria. The importance of destroying the gametes in the realization of the aims of hygiene seemingly makes it advisable to use a combination of quinin and Plasmochin. Quinin combats the acute infection in man and acts especially against the schizonts; Plasmochin destroys the gametes and rapidly deprives the mosquitoes of the capability of transmitting infection. From available experience it would appear that the Plasmochin-quinin combination might lead to a saving in quinin (exact tests in this direction would be valuable).

For clinical investigation it is suggested that the efficiency of Plasmochin without quinin be first determined in milder cases. However, for general practice the combination treatment will be more suitable because of the therapeutic advantage. Possibly in general practice—where conditions do not always permit accurate determination whether the case is one of tertian, quartan or tropical malaria, or mixed infection—it is best to use the combination (Plasmochin and quinin) in all cases, especially in regions where the comatose form is feared. Obviously, the destruction of the gametes can be demonstrated only by microscopic examination.

Quinin Idiosyncrasy:

A further advantage of Plasmochin is that it is well tolerated by patients who are hypersensitive to quinin (including those with black water fever), and may result in the reestablishment of tolerance for quinin.

Outline of Treatment:

Plasmochin is supplied in tablet form, viz.: (1) Tablets containing 0.02 gm. Plasmochin, with a central groove to permit even, as well as odd, fractional dosage. (2) Tablets containing 0.01 gm. Plasmochin and 0.125 gm. dry quinin sulphate.

It is advisable to give the daily amount in divided doses during or after meals. If Plasmochin is given on an empty stomach or in large individual doses (e.g. 0.05 gm.), spasmodic gastralgia may occur in sensitive persons.

Special directions include the following:

1. Patients with cardiac and renal diseases should not be treated with Plasmochin until further notice.

2. The usual daily dose for robust adults is 0.06, 0.08 or 0.1 gm., equivalent to three, four or five individual doses of 0.02 gm. For women and debilitated patients, the dose should be somewhat reduced.

3. For adults the greatest daily amount should be 0.15 gm., i.e., three doses of 0.05 gm. After large doses toxic symptoms may develop. For this reason it appears advisable not to exceed 0.1 gm. a day, even in robust adults.

4. The total daily quantity of three, four or five times 0.02 gm. Plasmochin should not be given for more than 5 days in succession. Then after-treatment should be undertaken in the same manner as with quinin, observing a routine somewhat like the following:

For 5 days	**Plasmochin treatment**
For 4 days	No treatment
For 3 days	**Plasmochin treatment**
For 4 days	No treatment
For 3 days	**Plasmochin treatment**
For 4 days	No treatment
For 2 days	**Plasmochin treatment**
For 5 days	No treatment
For 2 days	**Plasmochin treatment**
For 5 days	No treatment
For 2 days	**Plasmochin treatment**

5. The medicament should not be left with the patient for self-treatment, but each dose should be given by an attendant, so as to guarantee that the prescribed amount is administered.

6. Precaution: Upon the appearance of spasmodic gastralgia or cyanosis of the lips after a dose of Plasmochin, administration of the medicament should be discontinued immediately and should be resumed only after disappearance of the symptoms.

7. The results should be controlled by daily blood examinations (thick drop) until the disappearance of the parasites. Furthermore, blood examinations should be made at least on the first days of after-treatment with Plasmochin.

8. In tertian malaria and especially in quartan malaria, the routine treatment outlined in paragraph 4 rapidly causes the disappearance of the parasites from the peripheral blood in most cases, and apparently also prevents relapses. It is probable that three daily doses of 0.02 gm. Plasmochin will suffice in these cases.

9. In tropical malaria the combination treatment of Plasmochin and quinin is recommended at the start. The tablets containing 0.01 gm. Plasmochin and 0.125 gm. quinin sulphate are suitable for this purpose. Robust adults should receive 2 of these tablets two or three times daily for five successive days. Signet ring and crescent parasites will be destroyed simultaneously by this medication. The after-treatment should follow the routine already outlined for Plasmochin (see paragraph 4).

10. In cases of quinin idiosyncrasy (hemorrhages, etc.), Plasmochin has proved efficacious in numerous instances. It is recommended that Plasmochin be given in gradually increasing doses, beginning with 0.01 gm. twice

> a day until 0.02 gm. five times a day is administered. This should be followed by the usual after-treatment, the following routine being suggested for the whole course:
>
> | | |
> |---|---|
> | 1st day | 0.01 gm. twice |
> | 2nd day | 0.02 gm. twice |
> | 3rd day | 0.02 gm. three times |
> | 4th day | 0.02 gm. four times* |
> | 5th day | 0.02 gm. five times * |
> | 6th day | 0.02 gm. five times * |
> | 8th to 11th days | No treatment |
> | 12th day | 0.02 gm. five times * |
> | 13th day | 0.02 gm. five times * |
> | 14th day | 0.02 gm. five times * |
>
> thereafter for 4 days no treatment, for 3 days Plasmochin treatment, etc., as suggested under paragraph 4.
>
> 11. For black water fever the same method of treatment should be followed as for quinin idiosyncrasy.
>
> 12. It is advisable to watch the hemoglobin value of the blood during the course of treatment as, from previous experience, a rapid increase of the hemoglobin content occurs. The same applies also to an increase in body weight and to a decrease in size of the spleen. In examining the urine for albumin, only the boiling test with addition of acetic acid or sulpho-salicylic acid should be employed after Plasmochin has been administered. Reagents which simultaneously precipitate alkaloids, e.g., Esbach's reagent, should not be used as Plasmochin solutions form precipitates with these. However, such precipitates can readily be differentiated from albumin by the fact that they go into solution on heating and reform on cooling.

Mühlens[18] gave plasmochin its first tests in cases of naturally acquired attacks of human malaria. (A comprehensive paper will be published by him in *Beihefte des Archivs für Schiffs-und Tropenhygiene.*) His preliminary report on the subject carries the following statement:

> In Plasmochin we found the first drug that caused the disappearance of the crescents with experimental certainty within 5 to 7 days, even in cases where numerous crescents, apparently of recent origin, were present in the peripheral blood. Furthermore, in fresh cases of tropical malaria with numerous schizonts (signet rings) but without gametes, immediate treatment with Plasmochin almost always prevented the appearance of crescents; even during subsequent relapses under Plasmochin after-treatment, no crescents appeared in the peripheral blood. If relapse cases received after-treatment with quinin, crescents made their appearance within 10 days after the observation of signet rings and did not disappear again under continued quinin therapy, but, on the other hand, promptly vanished after renewed Plasmochin administration. In other words, it is absolutely in our hands, i.e., depending on the method of our treatment, whether we should permit the appearance or disappearance of the crescents. . . . My conclusions can be briefly stated: From the experiences with Plasmochin and Plasmochin Comp. at the Hamburg Tropical Institute, in the Balkans, in Spain and Italy, there is no doubt that this synthetic malarial agent is a discovery of first rank, and of inestimable significance to the malarial countries of the tropics. The possibility of destroying the crescentic gametes of

---

*3 to 5 times according to body weight

> severe tropical malaria, which are responsible for the transmission of the disease by mosquitoes, is in itself of enormous importance for a successful campaign against this serious tropical scourge. Without carriers of the crescents, the transmission of tropical malaria is inconceivable.

We have not had sufficient experience, thus far, to state what the final outcome of the use of plasmochin will mean to us, but the reports over a short period will be found on page 66 of this Annual Report. The administration of the drug is attended with some danger in certain individuals, as will be shown in the report of Dr. Wilhelm Cordes.

The general results of the malaria surveys of the tropical divisions have already been reported, but the simultaneous survey of anopheline breeding foci has not been discussed.

Mr. J. A. Corrigan, our General Sanitary Inspector, paralleled Dr. Clark's camp collection of blood films with a short-radius inspection for anopheline breeding about all camps and towns. It had already been our idea that the remote breeding areas did not deserve our attention, except under certain special conditions. The work of James has fortified our position in this respect. Mr. Corrigan surveyed the Company's nine divisions, and reported the following results:

There were 263 breeding foci in ditches, camp pools, and in rivulets of waste water from pipes, tanks, troughs, etc., as well as 31 in neglected containers, such as discarded wells, barrels, water troughs, and tanks.

Domestic or man-made breeding places yielded 74.5 per cent of the anopheline breeding foci discovered.

Wild breeding places (stream-banks, lagoons, etc.) yielded 25.5 per cent of the anopheline breeding foci.

It is not practical for us, in most instances, to attempt a control of anopheline breeding in the wild breeding foci. Certain compulsory conditions relating to a long flight of anophelines in order to obtain food, at times, will necessitate the treatment of stream-banks and lagoon surfaces. Corrigan's work shows that 75 per cent of the breeding foci are in artificial water collections near habitations. Anopheles that breed out in these areas have thus abundant opportunities to obtain human blood meals without the attendant risks of their destruction, during a long flight, by rain, wind, natural enemies, etc., or by being forced to feed on food materials other than blood. The longevity of the female mosquitoes bred out near camps is thus greatly enhanced according to James's[1] recent experience, and there is possibility of a high camp index of mosquito infection with malaria.

The anopheline mosquitoes normally seek sun-exposed sheets of water that contain a certain amount of vegetable material and algae. They select barrels, wells, tanks, cans, etc., only when these conditions are artificially fulfilled or when conditions are compulsory—as, for instance, when water sources are not available in their radius of flight. Our cane-field divisions are especially favorable to the spread of malaria, because the entire cultivated area is exposed to the sun and all water surfaces contain enough vegetation to furnish food for the larvae. The rural population is greater and more compact than in the fruit divisions. The use of draft animals enforces the use of water troughs with their proneness to form waste pools.

Generally speaking, the control of malaria among the labor force of such divisions is twice as difficult as in the shaded banana divisions, where the population in the rural regions is less dense. The practical problem that confronts us is the control of breeding in the immediate vicinity of camp and town sites, if we are to prevent abundant feeding on gamete carriers in camp and on returning cases discharged from the hospital.

All standing water exposed to sunlight represents potential breeding places for anopheline development. Any ditch that is worth digging is certainly worth being kept in good enough condition to function. All potential breeding surfaces should be eliminated by drainage, filling, or weekly treatments with an effectively applied larvacide. Dr. M. Barber's[19] experience with Paris green applied as a dusting powder has been a success and, without doubt, it is the method we must select in the treatment of most water surfaces that cannot be eliminated by drainage or filling.

Paris green is mixed with road dust or ashes: 1 part of Paris green to 100 parts of dust. One pound of this mixture, properly applied, will treat approximately 1,000 square feet of water surface. The mixture is carried in a light canvas bag with a shoulder strap, and is applied by using the wind as a conveyor and broadcasting the mixture by hand. Only a comparatively small amount is required. A grassy water surface, or one filled with cattail growth, requires more of the dust than a clean water surface. The application of the mixture to railroad ditches can be made from a motor car. A boom is attached to the side of the car so that it can be raised or lowered when necessary. From the end of the boom is swung a porous bag to the bottom of which a cord is attached. Jiggling the bag by jerking the cord causes sufficient dust to spread over the ditch while the car is in motion. This mixture will kill all surface-feeding larvae (anopheline) in two hours. Further experience will no doubt develop other methods of applying this mixture, such as the use of the motor car exhaust wherever practicable. The use of the airplane might be considered also where large areas must be treated.

CONCLUSIONS

Our present plan in attempting the control of malaria is as follows:

1. Institute a short-radius control of anopheline breeding in potential sheets of water, such as camp ditches, camp pools, and neglected water reservoirs of any kind. This is to be accomplished by drainage where possible, filling where indicated, and a weekly larvacide treatment of permanent water sheets.

2. Educate the personnel in the destruction, each morning, of engorged mosquitoes resting in quarters, by use of the fly-swatter or some insecticidal spray apparatus.

3. Continue the follow-up treatment, at camps and farm-houses, of discharged hospital cases of malarial fever.

4. Institute camp treatment of the laborers found off duty, and of the sick women and children in camp.

5. Use plasmochin and plasmochin comp. in hospital cases showing gamete carriers. The most abundant gamete carriers are naturally going to occur in the severe infections that demand hospital care; all such cases should be examined before their discharge from the hospital and, if found carrying gametes, should be held there and the special treatment with plasmochin should be repeated before their discharge.

Our hospitals should not be filled with the *mild cases of malaria.* The greater number of such cases can be treated satisfactorily in the camps, and the gamete carriers will do little harm if proper sanitation is observed about the camp.

Quinine should not be wasted by giving it as a prophylactic measure or issuing to others than those we have indicated.

The extravagant use of quinine plus the unnecessary hospitalization of mild cases of malaria would defeat our object.

We are attempting a practical control of malaria to reduce hospital admissions and supply more labor. This policy should tend toward the future reduction and stabilization of the labor force. A sympathetic cooperation of all concerned can accomplish this result.

REFERENCES

1. James, S. P., and Shute, P. G., "Report on the First Results of Laboratory Work on Malaria in England," Pub. by League of Nations Health Organization, Malaria Commission, Geneva, 1926
2. Le Prince, J. A., and Orenstein, A. J., "Mosquito Control in Panama," G. P. Putnam's Sons, New York, 1916, (pp. 208–211)
3. Le Prince, J. A., "Destroying Engorged Anopheles as a Malaria Control Measure," U. S. Public Health Report, Vol. LXI, No. 25, 1926, (pp. 1220–1226)
4. Clark, H. C., "The Comparative Incidence of Gametocytes in Untreated and in Briefly Treated Malaria," *Am. Journ. Trop. Med.*, Vol. VII, No. 1, Jan., 1927
5. Barber, M. A., and Komp, W. H. W., "Some Modifications of the Thick-film Method in the Examination of Blood for Malarial Parasites," *Proc. Internat. Conf. on Health Problems in Tropical America*, United Fruit Company, Boston, 1924
6. Wenyon, C. M., "Incidence and Etiology of Malaria in Macedonia," *Journ. Roy. Army Med. Corps*, 37, 1921, (p. 354)
7. Marchiafava, E., and Bignami, A., "Twentieth Century Practice of Medicine," Wm. Wood & Co., New York, 1900, Vol. XIX, (pp. 460–462)
8. Seguin, "Prophylaxie et Traitment du Paludisme," Abstracted by C. L. in *Trop. Dis. Bull.*, Vol. XXII, No. 10, Oct., 1925, (pp. 810–811)
9. Ovazza, V. E., "On the Permanence of Malarial Gametocytes," Abstracted by C. L. in *Trop. Dis. Bull.*, Vol. XXIII, No. 2, Feb., 1926, (pp. 145–146)
10. Catanei, A., "Malaria among Natives of Algeria in 1924–1925," Abstracted by C. L. in *Trop. Dis. Bull.*, Vol. XXIII, No. 7, July, 1926, (p. 525)

11. Van Hoof, L., "Malaria in the Leopoldville District," Abstracted by C. L. in *Trop. Dis. Bull.*, Vol. xxiii, No. 7, July, 1926, (p. 526)

12. Craig, Charles F., "A Manual of the Parasitic Protozoa of Man," J. B. Lippincott Co., Phila., 1926, (pp. 494–495)

13. Loeffler, F., "Malaria Diseases in Modern Clinical Medicine," D. Appleton and Co., New York, (p. 291)

14. Darling, S. T., "Transmission of Malarial Fever in the Canal Zone by Anopheline Mosquitoes," *Proc. Canal Zone Med. Assoc.*, 1909, (p. 37)

15. Ross, "Prevention of Malaria," John Murray, London, 1910, (p. 137)

16. Barber, M., "Some Observations and Experiments on Malayan Anopheles with Special Reference to the Transmission of Malaria," *Philippine Journ. Sci.*, Vol. xiii, Sect. B, No. 1, (p. 23)

17. "Summary of Results with 'Plasmochin' in Malaria," a Report Prepared for and Published by the Winthrop Chemical Company, Inc., New York, (pp. 3–7)

18. Mühlens, P., "The Treatment of Natural Malarial Infection in Human Beings with Plasmochin," a Report Issued from the Clinical Division of the Tropical Institute, Hamburg, Germany, and Published by the Winthrop Chemical Company, Inc., New York, (pp. 4, 5, and 15)

19. Barber, M. A., "Use of Paris Green as a Larvacide," Quoted by Deeks in "Malaria—Its Cause, Prevention and Cure," Special Publication, United Fruit Company, Boston, Mass., 1925, (p. 29)

ANOPHELES MOSQUITOES IN OUR TROPICAL DIVISIONS

A Compiled Report

H. C. CLARK, M.D.

It has long since been observed that the various species of anopheles mosquitoes have different degrees of susceptibility to malaria. Certain species appear to be natural transmitters of malarial fever, while others are rarely found naturally infected but can be infected under certain favorable laboratory conditions. Since there are important differences in the breeding habits of the various anopheline species, it is important to know those species that act as intermediary hosts, if anti-larval methods for mosquito control are to be applied in a practical manner.

In order to furnish a guide in our sanitary work and to supply a readily accessible reference to our anophelism, I have collected all of the authentic records that I could find directly related to the species identified within the actual limits of our tropical plantations, and in one additional region from which labor is from time to time recruited. These records include locations in eight countries in Central America, South America, and the West Indies.

Darling[1] (1909) reported 11 species of anopheline mosquitoes as having been collected in the Canal Zone. Of these 11, the 3 most prevalent were *A. albimanus*, *A. pseudopunctipennis*, and *A. malefactor*. He considered *A. albimanus* the most common anopheles taken in quarters and camp barracks, and also the most important vector of *P. vivax* and *P. falciparum*.

Root[2] (1924) reported *A. albimanus* in the Costa Rica Division and also on the plantations of the Tela Railroad Company. He found *A. eiseni* in a side pool at the headwaters of the Tela River.

Barber and Komp[3] report anopheline catches as follows:

Tela Railroad Company—Bred out from Larvae
A. albimanus
A. argyritarsis

Adults Caught in Quarters
A. albimanus (by far the most common)
A. argyritarsis
A. vestitipennis

Caught in Jungle or on Banana Farms
A. albimanus (one adult male)
A. vestitipennis
A. apicimacula
A. punctimacula

Truxillo Railroad Company—Bred out from Larvae
A. albimanus
A. crucians

Guatemala Division—Caught in Quarters
A. albimanus
A. pseudopunctipennis

Haiti (Port de Paix)—Bred out from Larvae
A. albimanus (also adults in quarters)
A. grabhamii

Bequaert[4] (1926), conducting a survey in the Cuban divisions at the beginning of the dry season, examined 8 villages and 11 farm regions. He concluded that the anopheline mosquito responsible for the spread of malaria in the Cuban divisions is *A. albimanus.* This species was bred from nearly every lot of larvae that he obtained.

He points out that the following 4 species of anopheline mosquitoes have thus far been recorded from Cuba: *A. albimanus* Wiedemann, *A. vestitipennis* Dyar and Knab, *A. grabhamii* Theobald, and *A. crucians* Wiedemann. (*A. cubensis* Agramonte is a synonym of *A. albimanus.*)

Bequaert observed 3 of the 4 species during his survey of these divisions, but *A. albimanus* was the only one at all common. One single specimen of *A. crucians* was bred from a lot of larvae collected at Santa Isabel, in the Preston Division. The same collection of larvae also yielded *A. albimanus.* A single female *A. vestitipennis* was caught on March 14th, about 9 P.M., in an unscreened room of the hotel at Preston, while in the act of biting.

All of these investigators consider that *A. albimanus* was the most common vector of malaria found by them.

During the year J. A. Corrigan, our General Sanitary Inspector, made very exhaustive surveys of all towns and camps in the Company properties. His observations in all these localities confirm the statement that *A. albimanus* is by far the most common anopheline mosquito found in quarters and in adjacent breeding areas. *A. argyritarsis* was seen occasionally in the quarters in some of the Colombia camps. *A. pseudopunctipennis* was found in some of the camps in Guatemala.

It is interesting, fifteen years after Darling recorded *A. albimanus* as the most important vector in the Canal Zone, to find another report from that locality which emphasizes the same fact. I quote from an article by D. P. Curry[5]:

> All the authorities are in agreement that, of our local *Anopheles*, the *albimanus-tarsimaculata* group is the greatest in importance. They fly farther, more persistently seek entrance into houses to feed upon human blood, and have a higher rate of infectibility with plasmodia than any of the others. . . . For emphasis I state plainly (and, doing so, I simply restate what others have long ago declared) that *Anopheles albimanus*, including the variety *tarsimaculata*, alone merits our extensive and expensive anti-malaria work here. Were this species not present upon the Isthmus, our malaria problem would probably dwindle to insignificant proportions.

Thus it can be seen that in the fight to control malaria we have to contend with the same hardy member of the anopheline group, *A. albimanus*, in all of our localities.

REFERENCES

1. Darling, S. T., "Transmission of Malarial Fever in the Canal Zone by Anopheline Mosquitoes," *Proc. Canal Zone Med. Assoc.*, 1909, (April, 1909, to March, 1910), (pp. 35–37)
2. Root, F. M., "Notes on Blood-Sucking Arthropods," Thirteenth Annual Report, Medical Dept., United Fruit Co., 1924, (p. 207)
3. Barber, M. A., and Komp, W. H. W., Special Surveys Appearing in Annual Reports, Medical Dept., United Fruit Co., 1923, (pp. 170–172), 1924, (p. 60), and 1925, (pp. 174–175)
4. Bequaert, Joseph, "Preliminary Report of Mosquito Investigations in the Preston and Banes Divisions, Cuba, of the United Fruit Company, (1926)," a Communication to the General Medical Office of the United Fruit Company
5. Curry, D. P., "Some Observations on Mosquito Control in the Canal Zone, with Especial Reference to the Genus Anopheles," *Am. Journ. Trop. Med.*, Vol. v, No. 1, Jan., 1925, (pp. 10–13)

SOME NOTES RELATING TO MALARIA AND BLACKWATER FEVER

Banes Hospital, Cuba

Blackwater fever in the Cuban divisions is confined, almost exclusively, to the Old World Spaniard and the high-caste Cuban races. It is just as likely to become a "household disease" as is malaria. We have recently received a report of 21 attacks during the past 5 years in a family consisting of 16 members.

During the course of Dr. H. C. Clark's malaria surveys, he found two persons in the Banes Division carrying an abundance of young aestivo-autumnal parasites unassociated, at the moment, with subjective evidence of illness. One of these people, within 6 hours after the taking of the blood film, came down with an attack of malaria fever associated with haemoglobinuria; and the other case 5 days later developed the same disease. These cases were admitted to the hospital immediately after they developed blackwater fever, and in neither case could malaria parasites then be found in the blood films.

At the request of Dr. Clark, members of the hospital staff attempted a direct inoculation of fresh whole blood from a case of blackwater fever into a negro patient, who was not suffering from any acute illness. About 10 cc. of blood was removed from the vein of a patient in his first paroxysm of haemoglobinuria, and was immediately injected into the vein of the negro. Observation ended at the close of 3 weeks, and the negro failed to develop either malaria or blackwater fever during that period.

One case of blackwater fever was treated with antivenin (anti-bothropic serum), which did not materially affect the course of the disease. The man recovered after his case had pursued the average course of blackwater fever.

Dr. Wilhelm Cordes* treated a case of dermatitis herpetiformis with the injection of a strain of malaria parasites, without noteworthy results so far as the course of the disease was concerned. His observations on the incubation period and the gametocyte appearance are worth reading in detail.

A PRECIPITIN TEST IN MALARIA

WILLIAM H. TALIAFERRO, PH.D., LUCY GRAVES TALIAFERRO, SC.D., AND ANNA B. FISHER, M.S.

For several years, the present workers have been attempting to devise a precipitin test for malaria. This task has been appreciably aided by a grant from the International Health Board, and, through the courtesy of Dr. W. E. Deeks and the United Fruit Company, the present series of tests were made at the Tela Railroad Company's hospital in Tela, Honduras. We are also greatly indebted to Dr. R. B. Nutter, Superintendent of Tela Hospital, and to his staff, who extended every courtesy and assistance possible.

This report is essentially preliminary, although the results strongly indicate that a precipitin test may be developed for the diagnosis of malaria. During our stay at Tela, 1,605 precipitin tests were carried out, with 37 different antigens, on sera from 535 persons. Of the latter, who came from both the ward and out-patient departments, 295 showed malarial parasites in either thick or thin films and 174 gave a thick-film negative, while 66 showed incomplete histories and hence data from them were discarded. As would be expected in a series such as this, most of the attempts proved valueless. These will be discussed in only a general manner, but the one antigen which gave the best results will be reported in detail.

***Archiv. für Schiffs und Tropenhyg.*, 1926, Band 30, S. 713–715

LITERATURE

Many papers have accumulated on the serology of malaria. Of these, some treat of miscellaneous properties of the blood of infected persons, and need not concern us further. Others—perhaps the majority—deal with various modifications of the Wassermann reaction; but since, in these, malaria is considered primarily as a possible complicating factor in the diagnosis of syphilis, and furthermore, since the Wassermann itself is probably not a true antibody-antigen reaction, these also will not be considered here. Of the remainder, there are a few papers on specific complement fixation in malaria, and at least two preliminary reports on a precipitin reaction. In view of the feeling among many immunologists that the antibodies involved in specific complement fixation and the precipitin reaction are identical, it seems advisable to review the previous work on both of these subjects.

Among the earlier workers, de Blasi (1907) was unable to obtain complement fixation in malaria, using as antigen red blood cells heavily infected with malarial parasites. Gasbarrini (1913) prepared an antigen for his very interesting complement-fixation studies by the earlier method of de Blasi, i.e., heavily parasitized red cells were washed 3 times in .9% sodium chloride, laked in distilled water, dried in a desiccator, pulverized, and later used in a 1–30 dilution. Of the 44 persons whose sera he worked with, 28 either had malaria at the time or had had a history of it; 15 had not had malaria (1 doubtful) but had had other diseases; and 1 was healthy. Tests with the 28 malarial sera were very irregular and chiefly negative, but when these sera were treated with sheep cells for 20–30 minutes, all but 4 gave positive complement-fixation tests. The non-malarial sera—either normal or treated—gave negative results. A control antigen made from the red cells of a healthy person gave uniformly negative results.

The question naturally arises, What is the inherent difference between the normal and the treated malarial serum? Gasbarrini believed that the treatment of the human serum with sheep cells freed it of its natural hemolytic antibody, by absorption. We do not feel, however, that this is the only explanation. It may be that some non-specific factor was removed which prevented the union of the malarial antigen and antibody with complement, but not the later sensitized sheep cells with complement. In view of the fact that such phenomena are known in other immunological reactions, it is to be regretted that Gasbarrini did not absorb the human serum with other agents besides sheep cells.

Very promising results on complement fixation were obtained by Thomson (1918, and especially 1919). Most of his work was done with an antigen prepared from parasitized red blood cells, by first culturing the material according to his and D. Thomson's modification of Bass and Johns' technique, so as to increase the number of parasites, then hemolyzing the red cells with distilled water, dissolving the sedimented parasites and cell debris in N/10 NaOH, neutralizing with normal HCl, and finally, just before use, diluting with physiological saline until there was no anticomplementary action. An antigen from heavily infected spleens in malignant tertian cases may prove even more promising, although his reactions so far have been rather weak, owing to his inability to obtain a heavily infected organ. His preliminary evidence indicates that, although there may be a certain amount of specific action, a given antigen probably shows a group reaction for all species of malaria as well. Pseudopositive reactions were obtained with syphilitic sera.

Horowitz-Wlassowa (1924) states that antigen for complement fixation may be prepared from the peripheral blood or placenta of acute malarial infections, or from the brain in cerebral localization. To 160 grams of minced placenta, he added 100 cc. of distilled water containing 0.1 gram of quinine hydrochloride and a few crystals of thymol; after shaking this, he allowed it to stand for 24 hours, then decanted and filtered the supernatant fluid to obtain a clear filtrate, which he used as antigen. After a study of 200 sera from normal and infected persons, he concluded that a complement-fixation antibody is formed in malaria, and may be present from 2 weeks to 5 years after infection, although during reinfection or relapse, when the parasites and especially the gametocytes are increasing in the blood, it shows no reaction. Furthermore, the amount of antibody and the time necessary for its formation depend upon varying conditions (the duration and intensity of illness, the individuality of the patient, etc.). Of 67 persons giving no history of malaria, 90.8 per cent were negative. Control antigens, such as an alcoholic extract of ox heart as used for the Wassermann reaction, Besredka's tuberculosis antigen, echinococcus fluid and an aqueous extract of normal placenta, all gave negative results.

The authors are aware of no extensive work on a precipitin test for malaria. The preliminary tests of Ziemann (reviewed in Ziemann, 1924) were unsuccessful. Pewny (1918) obtained precipitates within 20 hours, by using as antiserum the serum from patients infected with malaria and an antigen prepared from blood clots (Blutkuchen = placenta?) from a malarial patient. In the preparation of the antigen, the blood clot was added to twice its bulk of distilled water and, after digesting at 37° C. for 5 to 6 days, it was centrifuged, and the supernatant liquid was pipetted off and diluted with physiological saline. The best dilution was found to be 1 to 100. Pewny obtained negative results when this antigen was tested with fevers other than malaria. Both malarial and non-malarial sera were negative with an antigen prepared in a similar manner from a normal blood clot.

The previous results which have been reviewed leave little doubt but that under certain conditions specific complement fixing antibodies are formed in malarial infections of man. The mass of immunological evidence that specific complement fixation and precipitation are associated with the same antibodies, as well as the preliminary results of Pewny, led us to attempt to perfect a specific precipitin test for malaria. The great advantage of the precipitin test is its simplicity of technique and of performance, although in general it is not as delicate as complement fixation.

TECHNIQUE OF THE TEST

Since it was desirable in this work to use small quantities, especially of antigen, all of the tests were set up in very small tubes with an inside diameter of about 4 mm., a length of 50 mm., and a capacity of approximately .65 cc. In carrying out the tests, about .15 cc. of the heavier fluid (in most cases the antiserum or patient's serum) was pipetted onto the bottom of the tube, and then a like quantity of the lighter fluid (generally the antigen) was layered on top, care being taken that the two were not mixed. Afterwards, they were examined for a "ring" of precipitate, which formed between the layers.

Preliminary work showed that it was always best to use the antiserum (patient's serum) undiluted, as is generally recommended. With regard to the antigen, in by far the majority of cases the undiluted antigen gave the heaviest precipitate, although occasionally it was practically negative while a 1–5 dilution gave a heavy precipitate. For this reason, eight dilutions were at first used, but since positive results were obtained in the lower concentrations only when obtained in either or both of the undiluted and 1–5 dilutions, the usual set-up was as follows:

TABLE No. 1

Tubes	1	2	3 Control	4 Control
Undiluted patient's-serum	.15 cc.	.15 cc.	.15 cc.	0
Antigen	Undiluted .15 cc.	1–5 .15 cc.	0	Undiluted .15 cc.
.85% NaCl	0	0	.15 cc.	.15 cc.

These tubes were incubated at 37° C. for 1 hour, and were then placed in the ice box for from 6 to 9 hours. Readings were made after incubation and after sojourn in the ice box, although the second reading was accepted as final.

The amount of precipitate formed was estimated in three grades. A very heavy ring of precipitate between the antiserum and the antigen was termed +++, a very light but definitely positive ring was called +, and intermediate grades were designated ++. In Table 2, page 58, the three grades are indicated, but in the general discussion of other tests, + is applied indiscriminately to the three grades.

PREPARATION OF ANTIGENS, AND RESULTS OBTAINED

In attempting to find a specific precipitin test, in contradistinction to a non-specific reaction (viz., the Wassermann), it was essential that our antigen contain a large amount of dissolved malarial protein. This we procured from two sources

—heavily infected peripheral blood and placentas. In obtaining the former *Plasmodium vivax* infections proved unusually favorable, not only because heavy infections are not infrequently found, but also because the most advantageous time of extracting the blood can be readily gauged. *P. falciparum* infections, on the other hand, were generally unsuitable because practically nothing but small ring forms occur (besides the crescents, which were comparatively rare), although occasionally very heavy infections were encountered which warranted their use. Comparatively numerous *P. malariae* infections exist around Tela, but we did not find a single heavy one.

As is well known, the asexual stages of *P. falciparum* tend to become localized in the capillaries of the deeper organs and, as pointed out by Clark (1915), sometimes in the placenta. The great advantage of using infected placentas is that they probably yield the largest possible mass of malarial protein obtainable in a fresh condition. The disadvantages of using imperfect placenta, are: (1) that they are comparatively rare (Clark found only 19 out of 400 cases), (2) that they are available only from *P. falciparum*, and (3) that the resulting antigen necessarily contains a large proportion of tissue proteins. These last two drawbacks are minimized to a certain extent, since no sharp specificity seems to exist among the three species, and the admixture of tissue proteins appears to influence the reaction little, if any. We were unable to obtain, or to do any work with, organs from autopsies.

The malarial protein can be obtained freer from extraneous matter, in the case of peripheral blood, by laking the blood without injury to the plasmodia. We were somewhat handicapped in doing this, because a high-speed centrifuge was not available. Thomson has also increased the amount of recoverable malarial protein, by culturing the blood before laking with distilled water. In our experience, however, when 15 or 20 cc. of blood are cultivated, some of the malarial organisms live and reproduce, but so many die that the total number of parasites diminishes rather than increases.

All of the solvents which gave promising results were aqueous menstrua—a fact which again indicates that our antigen was a true solution of proteins, and that we are dealing with a true specific antigen-antibody reaction. The most useful of the various solvents tried was the slightly alkaline extracting solution of Coca (1922), which is an aqueous solution containing sodium chloride 0.5%, sodium bicarbonate 0.05%, and carbolic acid 0.4%. In no case were promising results obtained with lipoidal solvents, such as ether or alcohol. A preliminary extraction with ether, however, seemed to increase the potency of the antigen, which, by this process, was found in the ether *insoluble* portion.

By far the best results were obtained with an antigen prepared from a heavily infected placenta. The pulpy part—(the larger blood vessels and membranes were removed)—was run through a meat grinder and an equal amount of ether was added. After 18 days, the mass was filtered, and to 10 grams of the ether *insoluble* portion (i.e., the sediment), while it was still moist, were added 50 cc. of

Coca's solution. Subsequently, the mass was filtered, as needed, through hard filter-paper (Whatman's No. 50), and the clear filtrate was used as antigen. It was found to be active about a week after the addition of Coca's solution, and retained its activity for 5 weeks.

The results gathered from the testing of this antigen against 86 sera are given in Table 2, page 58. For purposes of easy reading, the patients are arbitrarily listed, first, in two groups (infected and non-infected), and secondly, in each of these groups they are classified according to intensity of the precipitin reaction. The serial number prefixed to each is also arbitrary, being given simply for reference. Under the column giving the diagnosis, not only is the type of parasite indicated, but three grades of infection are shown: (1) those which were sufficiently heavily infected to show parasites in a thin blood film, (2) those which showed no parasites in the thin film, but which were positive by the Barber thick-film method, and (3) those which showed only one or several parasites by the thick-film method (the number of organisms found follows the designation of the type of parasite). In the next column, "quin." indicates that the patient was bled after intensive treatment of quinine had been begun at the hospital; and "none" indicates that no quinine had been given at the hospital, although it was impossible to ascertain whether or not the patient had been taking quinine before entering the hospital. Results are also recorded to show whenever a Kahn Precipitation Test for syphilis was run, and whenever an examination for other parasitic diseases besides malaria was made, in the hope that these data will be useful in indicating the specific value of the precipitin test.

Examination of Table 2 indicates that, of the 54 infected persons, 45 gave a positive test (10+++, 21++, 14+), 2 gave a doubtful positive, and 7 were negative. Of the 32 uninfected persons, 6 gave a positive test (2++, 4+), 1 gave a doubtful positive, and 25 were negative. In other words, of the 54 infected persons 83 per cent were undoubtedly positive, and of the 32 uninfected persons 78 per cent were undoubtedly negative. This is a very high correlation. Moreover, in the case of the uninfected persons the correlation is probably higher, since in Honduras the natives are so frequently infected that some of the so-called negatives may have had a very low-grade infection which was overlooked in the blood-film examination. Such a condition might have been controlled to a certain extent, had it been possible to obtain accurate personal histories from the so-called uninfected group. An attempt was actually made, but proved valueless.

In any event, it is significant that of the 6 uninfected persons who gave a positive precipitin test, none was +++. A consideration of the uninfected cases which gave negative results clearly indicates that other parasitic infections, *Strongyloides*, *Necator*, *Trichuris*, *Ascaris*, *Endamoeba coli*, *E. histolytica*, and *Balantidium coli*, did not cause positive results. Similarly, two active cases of typhoid fever did not give positive results. This table does not show anything in regard to syphilitic sera, but subsequent tests with other antigens indicate that there was no more tendency for sera from cases of syphilis without malaria to react, than for non-syphilitic cases without malaria. Unfortunately, there are no quartan cases in this series. The results indicate, however, that the antigen is as powerful for *P. vivax* as for its homologous serum. Finally, there seems to be no correlation between the amount of precipitate and the number of parasites in the peripheral blood.

All tests in Table 2 were made with fresh sera, since they have been found to react the best. As a rule, after several days their activity is lost, although in a few strongly reactive sera it may be retained for as long as a month. Furthermore, heating the sera to 56° C. for 20 minutes either has no effect or slightly diminishes the titer.

The preliminary extraction with ether seems very desirable. Thus, an antigen was prepared from a similarly infected placenta, but was placed directly in Coca's solution without the preliminary extraction with ether, and with the addition of chloroform to inhibit bacterial action. With this antigen 69 tests were run. The first tests indicated that the antigen was far less reactive than the previous one, whereas later tests could not be regarded as reliable, since the material had become contaminated. In sum, then, the preliminary extraction with ether increases the specific reactive substance in the resulting antigen, and greatly decreases bacterial activity. The first of these effects is very interesting, in that Chibnall and Schryver (1921), in their method for extracting the nitrogenous material from green leaves, obtained highly satisfactory results simply by subjecting 5 parts of minced leaves to 4 parts of water saturated with ether, and then submitting the mixture to pressure. The permeability of the cell walls seemed in some way to be altered. Later, Chibnall (1923) used a preliminary treatment with ether, in his method for the separate extraction of vacuole contents and protoplasmic materials of leaves.

Various other preliminary treatments of the minced placenta were resorted to before the addition of Coca's solution. In one series, an equal amount of sodium chloride was added. After 11 days, the mixture was diluted with distilled water until the salt strength was .5 per cent. Then sodium bicarbonate and carbolic acid were added, to give the proper constituents for Coca's solution. After a week's digestion, the clear filtrate was used as antigen in 23 tests, with the following results: 16 sera from malarial patients gave 4 positives and 12 negatives, and 7 uninfected all gave negative results. Essentially similar results were obtained in 24 tests run with an antigen prepared by preliminary treatment with absolute alcohol, and with the alcohol insoluble portion digested in Coca's solution. Antigens prepared in aqueous menstrua, but from uninfected placentas, were very non-reactive.

Besides these preliminary treatments, it is interesting to note that antigens prepared from the alcohol and ether *soluble* portions were practically inert, as were antigens prepared from minced infected placentas by Noguchi's method for the preparation of the Wassermann reaction, and by Kahn's method for the preparation of the Kahn antigen.

The success with an antigen prepared from infected placentas raised the question as to whether or not a similar antigen could not be prepared from heavily infected blood cells. Seven such antigens were prepared and run against 234 sera. Of these, 2 became contaminated and the results were discarded. In 2 others, the washed, infected red cells were placed directly in Coca's solution without a preliminary hemolysis. Subsequent tests showed these antigens to be just as reactive with sera from uninfected as from infected individuals, a finding probably dependent upon the presence of large amounts of hemoglobin. The other 3 antigens were prepared in the following manner: About 20 cc. of blood were drawn from heavily infected patients (1 quartan, 2 aestivo-autumnal). The cells were washed once in citrate, twice in saline, and hemolyzed twice in distilled water. The blood debris and the malarial parasites obtained by centrifugation were then added to 5 cc. of Coca's solution and allowed to digest under chloroform; 67 tests were run with these 3 antigens. Of these, 49 sera from infected patients showed 25 positives and 24 negatives, and 18 from uninfected cases all gave negative results. These results correspond closely to those obtained when placental antigen was used without the preliminary treatment with ether. Lack of time prevented the ether treatment of blood cells, but it seems probable that as efficient an antigen can be prepared from blood cells as from placenta.

In this connection it is interesting to note that an antigen was very non-reactive which was prepared by washing *normal* red cells first in citrate, then twice in saline, and hemolyzing twice in distilled water, the cell debris being digested in Coca's solution. From infected cases, 24 sera showed 2 positive and 22 negative, and 4 sera from uninfected patients were all negative. This result strengthens the idea that in the positive reactions with the malarial antigens we are dealing with a true antibody reaction between antibody and specific malarial antigen.

The success reported by Horowitz-Wlassowa in the use of an antigen prepared from placentas by the addition of quinine hydrochloride led us to test their antigen for our precipitin work. Unfortunately, at the time of our experiments, this work was known to us only in an abstract which gave an incorrect proportion of placenta and quinine solution. In consequence, we prepared 2 antigens from infected placentas, using 15 grams of minced placenta to 100 cc. of 0.1% quinine-hydrochloride solution, and 3 from infected blood cells with about the same proportions. In all cases the antigen was unsuitable, as it reacted with normal sera just as readily as with malarial sera, and even showed a tendency to flocculate in the saline control-tube. In the case of antigens prepared from infected blood cells, it did not improve conditions to hemolyze the cells first. Furthermore, antigen prepared from an uninfected placenta gave just as contradictory results. It is, of course, possible that had we used the proportions designated by Horowitz-Wlassowa, we might have obtained more consistent results.

The attempt was made to prepare an antigen from infected red cells by first hemolyzing the cells, dissolving the sedimented cell debris and plasmodia in N/10 NaOH, and neutralizing with normal and N/10 HCl. Nevertheless, although we followed Thomson's procedure as closely as possible, the neutralization always precipitated the dissolved proteins. Similar results were obtained with infected placentas. When neutralizing with other reagents, such as $NaHCO_3$, was done, the resulting antigen was either non-reactive or indiscriminately reactive.

The evidence that the racemization of proteins (see Wells, 1925, p. 40) may cause the proteins to lose their antigenic properties, whereas treatment with acid does not, led us to dissolve infected cells and minced infected placental tissue in normal HCl acid, and then to neutralize with N/10 NaOH. Here, as before, neutralization precipitated the dissolved proteins. We feel, however, in view of Thomson's work as well as similar work on bacterial antigens, that both of these methods may be utilized when the technique is perfected.

In conclusion it may be said that the present precipitin test seems to be a specific antigen-antibody reaction, and not a non-specific flocculation, since only those antigens were reactive which were based on an aqueous menstruum and contained malarial proteins. This is of interest in the study of those immune reactions of the body which follow infection with malaria. Furthermore, the possibility of perfecting the test may be of considerable practical importance in the diagnosis of the disease. At the present time, a high degree of perfection has been reached with various thick-film methods, but the possibility remains that immunological reactions, such as the precipitin test, may be developed so as to detect infections of even lower grade.

SUMMARY

In a series of 1,605 precipitin tests on the sera of 535 persons (295 with malarial parasites in the peripheral blood, 174 negative and 66 doubtful) with 37 different "antigens," the following preliminary conclusions are indicated:

1. The best antigen was prepared from a heavily infected placenta, by mincing in a meat-chopper, extracting with ether, digesting the ether *insoluble* portion in the slightly alkaline solution of Coca, and using the clear filtrate as antigen.
2. When the sera from 54 infected persons were tested with this antigen, 45 gave a positive test (10+++, 21++, 14+), 2 a doubtful positive, and 7 negative. When tested against the serum of 32 persons showing a negative thick film for malaria, 6 gave a positive test (2++, 4+), 1 a doubtful positive, and 25 negative.
3. Some results indicate that efficient antigens can be prepared from infected red blood cells, provided they have a preliminary extraction with ether.
4. All of the data indicate that the precipitation is a specific antigen-antibody reaction, and not a non-specific flocculation.

LITERATURE CITED

de Blasi, D., 1907, "Sulla Deviazione del Complemento Nella Malaria Umana." *Ann. d'Ig. Sper.* **17** : 677–688 (cited in *Cent. Bakt., Ref.* **42** : 160)

Clark, H. C., 1915, "The Diagnostic Value of the Placental Blood Film in Aestivo-autumnal Malaria." *Journ. Exp. Med.*, **22** : 427–444

Chibnall, A. C., 1923, "A New Method for the Separate Extraction of Vacuole and Protoplasmic Material from Leaf Cells." *Journ. Biol. Chem.*, **55** : 333–342

Chibnall, A. C., and S. B. Schryver, 1921, "Investigations on the Nitrogenous Metabolism of the Higher Plants": *Part I.* "The Isolation of Proteins from Leaves." *Biochem. Journ.* **15** : 60–75

Coca, A. F., 1922, "Studies on Specific Hypersensitiveness." *Journ. Immunol.* **7** : 163–178

Gasbarinni, A., 1913, "Das Bordet-Gengousche Phänomen (Komplementablenkung) bei Malaria." *Zeit. Immunitätsf. Orig.*, **20** : 178–197

Horowitz-Wlassowa, L., 1924, "Experimentelle Beiträge zur Frage der Malariaimmunität (Spezifische Komplementablenkungsreaktion bei Malaria)." *Zeit. Immunitätsf.*, **40** : 268–277

Pewny, W., 1918, "Prazipitinversuche bei Malaria." *Wien. klin. Wchn.*, **31** : 205–206

Thomson, J. G., 1918, "Preliminary Note on the Complement Deviation in Cases of Malaria: a New Aid to Diagnosis." *Brit. Med. Journ.*, (Dec. 7): 628–629

1919, "Experiments on the complement fixation in malaria with antigens prepared from cultures of malarial parasites (*Plasmodium falciparum* and *P. vivax*)." *Proc. Roy. Soc. Med.*, **12**: 39–48

Wells, H. G., 1925, New York, "The Chemical Aspects of Immunity," (p. 254)

Ziemann, H., 1924, Leipzig, "Malaria und Schwarzwasserfieber." Mense: *Handbuch der Tropenkrankheiten*, Vol. III, (p. 592)

TABLE NO. 2

Precipitin results with an antigen prepared from a heavily infected (*Plasmodium falciparum*) placenta, extracted with ether, the ether *insoluble* portion being digested in Coca's solution

Number	Diagnosis		Quinine	Parasitic and Other Infections	Precipitin Results
	Thin	Thick			
1		E-A (3)	None		+++
2		E-A	None		+++
3		E-A	None		+++
4		E-A	None		+++
5	Ter		None		+++
6	Ter		None		+++
7		E-A	Quin.		+++
8	Ter		Quin.		+++
9	Ter		Quin.		+++
10		E-A	None		+++
11		E-A	None		++
12		E-A	None		++
13		E-A	None	Hookworm	++
14		E-A	None	Hookworm	++
15		E-A	None		++
16		E-A	None		++
17	Ter		None		++
18	Ter		None		++
19		E-A & Ter	Quin.		++
20		E-A & Ter	Quin.		++
21		E-A & Ter	Quin.		++
22		E-A & Ter	Quin.		++
23		E-A	Quin.	*T. trichiura*	++
24		E-A	Quin.	*E. histolytica.* Kahn* –	++
25		E-A	None		++
26		E-A	None		++
27		E-A	None		++
28	E-A		None		++
29	E-A		None		++
30		E-A	None		++
31		E-A	None	Hookworm. Kahn –	++
32		E-A	None	*E. histolytica*	+
33		E-A	None	*E. histolytica*	+
34		E-A	None	*E. histolytica*	+
35		E-A (2)	Quin.		+
36		E-A	Quin.		+
37		E-A (2)	Quin.	Hookworm	+
38		E-A	Quin.	Kahn +	+
39	E-A		None		+
40		E-A		Kahn +	+
41		E-A			+
42		E-A	None		+
43	E-A		None		+
44	E-A		None		+
45		E-A	None		+
46		E-A	None	*A. lumbricoides.* *T. trichiura.* *Kahn* –	+?

* Kahn's test for syphilis

TABLE 2—*Continued*

Number	Diagnosis		Quinine	Parasitic and Other Infections	Precipitin Results
	Thin	Thick			
47		E-A	None	*B. coli.* Hookworm. *T. trichiura.* Kahn –	+?
48		E-A	None	*E. histolytica*	–
49		E-A (1)	None		–
50		E-A	None		–
51		E-A (1)	None		–
52		E-A	None		–
53		E-A	None		–
54		E-A (4)	None	*A. lumbricoides. T. trichiura. E. coli.* Kahn –	–
55	Neg.			*A. lumbricoides.* Hookworm.	++
56	Neg.			*A. lumbricoides. T. trichiura.*	++
57	Neg.				+
58	Neg.			*S. stercoralis.* Kahn –	+
59	Neg.			*A. lumbricoides.* Hookworm. *T. trichiura.* Intestinal flagellates.	+
60	Neg.				+
61	Neg.				+?
62	Neg.			*A. lumbricoides. T. trichiura. E. coli.*	–
63	Neg.			*A. lumbricoides. T. trichiura. E. histolytica.*	–
64	Neg.			*T. trichiura. S. stercoralis. E. histolytica.*	–
65	Neg.				–
66	Neg.				–
67	Neg.			Hookworm. *T. trichiura.*	–
68	Neg.			*B. coli.* Hookworm.	–
69	Neg.			Hookworm. *B. typhosus.*	–
70	Neg.				–
71	Neg.				–
72	Neg.				–
73	Neg.			*B. coli.* Hookworm.	–
74	Neg.			Hookworm. *B. typhosus.*	–
75	Neg.			*E. histolytica.* Kahn –	–
76	Neg.			Kahn ±	–
77	Neg.			*S. stercoralis. T. trichiura.*	–
78	Neg.				–
79	Neg.			*A. lumbricoides*	–
80	Neg.				–
81	Neg.			Hookworm. *T. trichiura.*	–
82	Neg.			*A. lumbricoides. E. coli.* Hookworm.	–
83		Neg.		No intestinal parasites	–
84		Neg.		No intestinal parasites	–
85		Neg.		Hookworm. *A. lumbricoides. T. trichiura. B. typhosus.* Kahn –	–
86		Neg.		Hookworm. *A. lumbricoides. T. trichiura. S. stercoralis. Kahn* –	–

* Kahn's test for syphilis

MERCUROCHROME 220 SOLUBLE IN THE TREATMENT OF MALARIA

H. M. WALKER, M.D.

Truxillo Railroad Company Hospital, Puerto Castilla, Honduras

Nine cases of malaria were treated with mercurochrome 1% solution intravenously. There was no selection of cases; all patients admitted to the hospital between October 23 and December 4, 1926, showing tertian or quartan malaria were treated with mercurochrome, with the exception of two who had amoebic dysentery also. Eight of the cases were tertian, and one was quartan. Two of the tertian cases, however, were later found to have aestivo-autumnal malaria as well. These were observed for some time, later.

An initial dose of 15 cc. was given to all patients except one, a child of 14 years. Five received a second dose of 15 cc.; 2 patients who had a marked stomatitis following the first dose were given only 10 cc. as a second dose; and 2 patients with negative blood films for 8 and 9 days after the first dose received no more mercurochrome. Frequent blood smears were taken, both thin and thick films, from all patients. Red cell counts were made on all patients before, and a week after, the mercurochrome was given. Several examinations of the urine were made in each case.

Case 1. — Tertian parasites were present in thin and thick blood films taken on admission. They were absent on the 3rd day after mercurochrome treatment, and remained absent when the patient was discharged from the hospital 7 days later. The patient was seen in the out-patient clinic 3 weeks later. He had had no fever in the meantime, and the blood examination was negative for parasites.

Case 2. — Tertian parasites were present in thin and thick blood films taken on admission. The day following mercurochrome treatment, the thick film showed a few parasites. Daily examinations thereafter for 10 days were negative for parasites, and the patient's temperature remained normal after the 1st day.

Case 3. — Tertian parasites were found in thin and thick films on admission, and were present in thin and thick films each day for several days following mercurochrome treatment. The temperature after the first 3 days remained normal for 1 week, during which time daily blood examinations of thick and thin films proved negative. Parasites again appeared, with a temperature range of 99° to 101° F. A second dose of mercurochrome was given on the 17th day. Parasites were found in the thick film the following day, but the blood was negative thereafter until date of discharge from the hospital, 9 days later, and after 7 days of normal temperature.

Case 4. — Tertian parasites, present in thick film on admission, were found daily after mercurochrome treatment. Aestivo-autumnal parasites were found on the 7th day and a second dose of mercurochrome was given on the 8th day. The patient had some temperature daily, with aestivo-autumnal parasites in the thick film, until the 12th day, when he was given quinine and ran an afebrile course until discharged, 7 days later.

Case 5. — Tertian gametes were found in thin and thick films on admission. The day following administration of mercurochrome, crescents were found in the thick film. On the 6th day the temperature was 101° F., and the 7th day the temperature reached 103° F., notwithstanding the administration of a second dose of mercurochrome on the 5th day. Daily examinations of the blood showed aestivo-autumnal parasites in thin and thick films. On the 10th day the patient was given quinine and ran an afebrile course until discharged, 6 days later.

Case 6. — Tertian parasites were found in the thick blood film on admission. For 5 days following mercurochrome treatment, the daily temperature varied from 98° to 99.5° F., and the blood was negative. Although the patient then felt well and had no fever, the blood again showed parasites in both thick and thin films. A 2nd dose of mercurochrome was given 9 days after the first dose, and tertian parasites were found in the thick film for 3 days, the temperature remaining normal. On the 5th day after the second dose of mercurochrome, many parasites (tertian) were found in thin and thick films. The patient was then given quinine. He was discharged 4 days later with a negative blood.

Case 7. — Tertian parasites were found in thin and thick blood films on admission. Mercurochrome was given on the 2nd and 6th days without effect. The height of the daily temperature varied from 102° to 106° F. Tertian parasites were found in the blood films taken every day, up to the 11th day, when the patient was given quinine. The temperature immediately came down to normal, and the patient was discharged with a negative blood 6 days later.

Case 8. — Tertian parasites were found in thin and thick films on admission. Mercurochrome was given on the 2nd and 6th days. The patient had a daily chill, with temperature 104° to 105.5° F. Parasites were found daily in thin and thick films. Quinine was given 2 days after the 2nd dose of mercurochrome and the temperature was normal until time of discharge, 6 days later.

Case 9. — Quartan parasites were found in thin and thick films. Mercurochrome was given on the 2nd and 8th days. The patient had a chill and a temperature 103.5° F. on the 3rd and 6th days. Thereafter he had a temperature between 99° and 101° F. each day until quinine was given, on the 13th day. Parasites were found daily in the thick film during the period of mercurochrome treatment.

COMMENTS

The usual difficulty was experienced in getting patients to remain in the hospital for an extended length of time, and some cases have complained of the method of treatment with mercurochrome and asked for quinine. No cases were taken as controls, but we have kept in mind the fact, as proven in Ancon Hospital several years ago, that rest in bed and an adequate diet will often result in a clinical cure with negative blood in some cases of malaria, especially the tertian type.

As the case reports show, 3 of the tertian malarias were cured, 2 receiving 1 dose each of mercurochrome, and the other case receiving 2 doses. The 2 patients (Cases 1 and 2), who required only 1 dose of mercurochrome, had taken less than 20 grains of quinine before admission to the hospital. They were discharged on the 11th and 12th days, respectively. The other of these 3 (Case 3) was discharged on the 29th day.

Three other cases of tertian malaria (Cases 6, 7, and 8) receiving 2 doses of mercurochrome showed no improvement afterward. Two continued with high temperatures; the other had little or no fever, but an increasing number of parasites in the blood films.

Two cases entering the hospital, showing tertian parasites (Cases 4 and 5), showed the presence of aestivo-autumnal parasites after receiving the first dose of mercurochrome. No tertian parasites were encountered afterward. The reappearance of latent aestivo-autumnal malaria following the intravenous use of mercurochrome has been mentioned by Hooper in his work in Mexico. We have not, however, been able to obtain his excellent results in the use of this drug in tertian malaria.

Mercurochrome as an agent stimulating the haematopoietic system, and thereby affecting cures in malaria, may be disregarded. Variations in the counts of erythrocytes were slight when taken immediately before, and one week following, the intravenous use of mercurochrome. Three patients (Cases 6, 9, and 3) had an increase of 100,000 to 250,000 erythrocytes. In one patient (Case 5) there was no change, and in the other 5 there was a decrease of from 20,000 to 520,000 erythrocytes; 2 of the cures appearing in this group showed marked decrease in red cells.

The use of mercurochrome intravenously, in this hospital, in several hundred cases of various types of disease, has not been attended by danger as mentioned by Piper.[1] It has repeatedly been given to patients in this series of cases, as well as in others having a mild nephritis, without the untoward results which were noticed by Dundas and Telang.[2] Stomatitis, diarrhoea, and albuminuria in most cases have rapidly disappeared, and no permanent damage has resulted in any case.

Neither the praise nor the marked criticism which mercurochrome has received since its introduction into medicine can be given here. It has unfortunately been proclaimed a "cure-all" and, as such, has naturally failed. Further study, including a careful search for parasites in the thick film, with a follow-up on the patient after he has been discharged from the hospital, will, I believe, decrease the number of supposed "cures" of malaria—and it must be borne in mind that patients having parasites in the peripheral circulation do not always have symptoms referable to malaria.

The brilliant cures of malaria, 100 per cent of cases, obtained by Avison and Koo,[3] using a single intravenous injection of mercurochrome, have not been obtained in this series of cases, and its use can not be advocated at this time.

Note. — Case 2 returned for hospital treatment 38 days after discharge. Repeated examinations of blood were made, and no tertian parasites were found; however, the patient had a heavy aestivo-autumnal infection.

REFERENCES

1. Piper, E. P., "Present Status of Intravenous Use of Mercurochrome," *Am. Journ. of Obst. and Gyn.*
2. Dundas, J. D., and Telang, D. M., "Inefficiency of Mercurochrome in Treatment of Malaria," *Ind. Med. Gaz.*
3. Avison, D. B., and Koo, B., "Mercurochrome in Treatment of Chronic Malaria," *China Med. Journ.*

TREATMENT OF HAEMOGLOBINURIC FEVER WITH THE USE OF HAEMOSTATIC SERUM INTRAVENOUSLY

RICARDO AGUILAR, M.D.
Quirigua Hospital, Guatemala

In our 1923 Annual Report, reference was made to the treatment of haemoglobinuric fever by means of anti-streptococcus serum, a method introduced by Dr. O. G. Cranford, of Sasser, Georgia. This suggested the idea of trying the haemostatic serum "Lapenta" (Parke, Davis & Company), which is used for stimulating the coagulating power of the blood.

The following report deals with the treatment of 20 cases of haemoglobinuric fever (blackwater fever) with this serum.

Of the 20 cases reported, the blood examinations of the peripheral blood for malaria showed 10 positive for *Plasmodium falciparum*, 3 for *Plasmodium vivax*, and 7 negative for malaria parasites. The disease in these 20 cases presented 3 different clinical types:—12 cases were acute, 5 sub-acute, and 3 paroxysmal in character. They were distinguished by the following symptoms:

Acute Type. — These patients suffered from severe headache and backache, chills and fever, and had temperatures ranging from 103° to 105° F. There were persistent retching and bilious vomiting. The conjunctivae and the skin were slightly icteric, becoming progressively more deeply tinged, until a frank appearance of jaundice was noted. All of these cases were extremely restless and could not sleep, some of them being admitted to the hospital in a state of delirium; spleen and liver were enlarged, easily palpable, and painful on pressure. There was usually more or less constant epigastric pain. The tongue was coated and dry, and constipation was always present. There were intense thirst and extreme weakness.

Sub-Acute Type. — The patients in this class gave a history of having had one or two previous attacks of haemoglobinuria, and of having suffered from chronic malaria; they had taken quinine intermittently and had voided black urine afterward. There were no repeated chills, nor extreme restlessness with delirium, in these cases; their temperatures oscillated between 101° and 103° F. Vomiting was not frequent or troublesome. There was some general weakness, but the nervous reaction was milder than in the acute type. All of these patients were markedly jaundiced. The skin was dry and squamous, and anaemia was evidenced by the marked pallor of the mucous membranes and palms of the hands. The tongue was pale and coated; gums showed gingivitis and bled easily, and there was a fetid odor to the breath. Complete anorexia was present. These patients suffered less from thirst than those of the acute type. The liver and spleen were enlarged, particularly the spleen. The urine was black and abundant from the beginning of the attack.

Paroxysmal Type. — Many symptoms similar to those in the above-mentioned types were noted. The distinguishing feature was the appearance of the haemoglobinuria in successive attacks, which were ushered in by chills lasting from 1 to 2 hours and followed by fever, which often rose to 105° F. The first urine voided after the chill was black. Temperature returned to normal, and the urine cleared. One attack was followed by another with the subsequent return of all the symptoms, although they were somewhat milder in character. There was frequently a mild delirium, and usually some bilious vomiting.

Of the 20 cases treated with haemostatic serum, 12 were of the acute type, 5 of the sub-acute type, and 3 of the paroxysmal type. The results obtained were as follows: The urine of 9 cases of the acute type was negative for haemoglobin 2 days after admission to the hospital. In one, the urine was clear the day following admission. In another, the urine became negative for haemoglobin 3 days after admission. The serum was administered intravenously in doses of from 2 to 4 cc. diluted with 20 cc. of normal saline solution, given once or twice daily for the first 2 days. In the case whose urine cleared on the day following admission to the hospital, 2 injections of 4 cc. each were given on the day of admission. In the other case in which haemoglobinuria lasted for 3 days after admission, an injection of 4 cc. of the serum was administered intravenously twice a day during the first 3 days. The serum treatment was then suspended, and the urine remained clear for 14 days, when there was a recurrence of the haemoglobinuria. This recurrence was coincident with a radical change in the patient's diet—i.e., from liquid to full. The only explanation that can be offered for the recurrence is that the full diet may have increased the amount of peptones in the blood, thereby increasing the liver producing anti-coagulant, heparin. On the day of the recurrence, the patient was given 2 doses of 4 cc. each of the haemostatic serum, which dose was repeated once daily on the 2 following days. After these 4 injections were administered, the haemoglobinuria was controlled. This case would seem to indicate that the diet should be restricted for a longer period than it usually is during the convalescence of blackwater fever; and that it should be gradually increased and modified, according to the general condition of the patient and the promptness with which he responds to treatment.

The results obtained with haemostatic serum in the 5 sub-acute cases are described below:

The urine of 3 of these cases was negative for haemoglobin the day after admission. Each one had received 2 injections of 2 to 4 cc. of the serum intravenously. In 2 cases the urine cleared up after 2 days. One of the latter suffered a recurrence on the 12th day after admission, after voiding clear urine for 10 days. This recurrence also followed the prescription of a full diet, which may have had the same influence as pointed out in the case of recurrence in the acute type.

Of the 3 cases of the paroxysmal type, the first had intermittent haemoglobinuria for 5 days before the treatment with haemostatic serum was instituted.

Two days after treatment with the serum (4 cc. twice daily for 2 days) the haemoglobinuria was controlled.

The second case was controlled after two days' treatment with 4 cc. of the serum, given twice daily.

The third case was given one injection of 4 cc. of the serum on the day of admission to the hospital, and the following day the haemoglobinuria disappeared. On the 3rd day the haemoglobinuria recurred, and another injection of 4 cc. of the serum was given. The urine cleared on the 4th day. On the 6th day there was a second recurrence; a 3rd injection of 4 cc. was given, and the following day the haemoglobinuria permanently disappeared.

Each subsequent attack of haemoglobinuria in this patient was milder, and the urine examination showed less haemoglobin than during the previous one.

In 1924 haemostatic serum was used in this hospital in the treatment of 9 cases of blackwater fever,* with a result of 8 recoveries and 1 death.

The rationale of the treatment is based on the belief that in haemoglobinuric fever the anti-haemolytic substance in the blood is at fault, and that the injection of normal horse serum supplies this anti-haemolytic substance and thus prevents further haemolysis.

Haemostatic serum (Lapenta) is used on the same principle, and can be administered either hypodermically or intravenously in doses of 2 to 5 cc. every 4 to 6 hours. In most of this series of cases, it was given intravenously in doses of 4 cc., diluted with 20 cc. normal saline solution. There were no symptoms of anaphylaxis or other ill effects from its use.

Patients under treatment for blackwater fever should be kept strictly in bed until their convalescence is well established and advanced. They should be kept warmly covered with blankets to promote diaphoresis. When vomiting is persistent and they are unable to absorb sufficient fluids (when taken by mouth) to prevent dehydration, normal saline solution by hypodermoclysis or by the Murphy drip method should be given.

When malaria parasites are present in the blood, quinine should be administered in doses of from 3 to 7½ grains intramuscularly every 4 to 6 hours, until the blood is negative and the temperature is normal.

The heart action should be carefully watched, and cardiac stimulants, such as caffeine, camphorated oil, and digitalis, should be administered when indications arise.

Suppression of the urine, a most serious complication, always warrants a grave prognosis. The treatment for this condition in a case of blackwater fever does not materially differ from the methods used in any other form of acute nephritis with suppression.

The diet should consist of fruit juices, milk, and other liquids until the urine is clear and convalescence well established, after which a light diet may be given and gradually increased to the full.

---

* Macphail, N. P., 1924 Annual Report, Medical Department, United Fruit Company

During convalescence and after discharge from the hospital, a tonic of iron, quinine, and arsenic should be prescribed. If this is not done, a certain percentage of the cases will relapse with malaria.

CONCLUSIONS

Haemostatic serum was used in the treatment of 20 cases of blackwater fever with apparently beneficial results. There were no deaths in the series, nor were there any untoward symptoms that might be attributed to the use of the serum. Usually, the fatalities in blackwater fever are reported as 15 per cent or more in a large series. While 20 cases are not a sufficient number from which to draw definite conclusions, we feel that the results obtained warrant further trial of this remedy.

EXPERIENCES WITH PLASMOCHIN IN MALARIA

(PRELIMINARY REPORTS)

We were not able to obtain a supply of plasmochin at a sufficiently early date to carry on observations in a large series of cases over an extended period of time. Our experience, therefore, covers only a brief interval at the close of the year. We present below some preliminary reports that have been received from a few of our hospitals.

Dr. Wilhelm Cordes, of Preston Hospital, Cuba, renders the following report concerning the action of plasmochin compound on the *gamete forms* of the aestivo-autumnal parasite:

At the 1926 meeting of the Association of German Scientists and Physicians in Düsseldorf, several papers[1] were read on the discovery of plasmochin, a new specific remedy for malaria. Hörlein described it as a derivative of the chinolin nucleus and as synthetically built up, like salvarsan and Bayer 205, on the principles of modern chemotherapy. Roehl experimented with plasmochin on bird malaria, and found it 60 times more active than quinine, with a therapeutic index of 1 : 30. Sioli determined the human dosage, and also demonstrated its effectiveness in the treatment of tertian malaria which had been artificially inoculated for the treatment of general paralysis. Mühlens experimented with plasmochin on different types of human malaria (mosquito-borne), and reached the conclusion that in tertian and quartan infections plasmochin alone acts as well as quinine, and that relapses are less frequent than when quinine alone is used. In aestivo-autumnal malaria, he recommends combining both drugs. While quinine seems to have a better effect on the schizonts, plasmochin destroys the gamete forms (crescents) and prevents their formation.

The last-mentioned point is especially interesting, and is the strongest argument in the future treatment of malaria with this drug. *Mühlens* says:

> For the first time, we have found a medicament which causes the crescents to disappear within 4 to 7 days with the certainty of an experiment. . . . In acute infections of aestivo-autumnal malaria with many schizonts (rings ++++) and without gametes, plasmochin treatment, immediately instituted, nearly always prevented the appearance of crescents.

It is well known that, in a certain percentage of aestivo-autumnal malaria cases, an examination of the blood will show the presence of gametes after all acute clinical symptoms of the disease have disappeared. These gametes are not visibly influenced by quinine or any other drug heretofore used, and can be found in the peripheral blood for weeks and even months afterward. These crescent-carriers are, insofar as our knowledge goes, responsible for the infection of mosquitoes and the propagation of the disease. Recently, Dr. H. C. Clark[2] reports from different malarial regions of Central America that 45.9 per cent of the briefly treated malaria cases which were discharged from the hospital as able to work after all acute symptoms had subsided were still positive for parasites, usually gametes (crescents). Provided that such cases after treatment are infective for the mosquito, he adds that they are a greater menace in the labor camps for weeks to come than the usual untreated case that one finds in field surveys. In tropical-plantation hospitals, the laborers are generally treated through the acute stages of malaria and then returned to their unfavorable camp surroundings. To free these patients of the gamete form of the parasite is certainly a most important problem in malaria control; and if the contention of Mühlens holds true, plasmochin may represent a new and powerful weapon in the control of aestivo-autumnal malaria.

How many crescents must necessarily be present in the peripheral blood to infect mosquitoes? Ziemann[3] quotes Darling's authority, that 1 cmm. of blood must contain 12 crescents to produce oöcysts in the mosquito. Darling evidently fixes the lowest limit, based on quantitative calculations, which produced anopheles infection. A single examination with negative results does not prove that the blood in a given case of malaria is entirely free from crescents; but in such a case their number is certainly below the limit mentioned. In a regular thick-film examination and with 3 minutes' search, 100 to 150 microscopic fields can be covered, each containing 20 to 25 leucocytes. This means that ¼ to ½ cmm. of blood is surveyed. If in this amount no crescents are found, there is every probability that mosquito infection will not occur from a patient who is discharged from the hospital with a negative thick blood film.

The I. G. Farbenindustrie Aktiengesellschaft, in Leverkusen, Germany, presented this hospital with a liberal supply of plasmochin compound (plasmochin combined with quinine) for clinical tests. Its action in comparison with quinine alone was studied in a continuous series of 72 cases. The total number of patients admitted to the hospital with aestivo-autumnal malaria was divided into two groups. The odd Nos. 1, 3, 5, 7, etc., were subjected to the routine quinine treatment—i.e., 2 grams of quinine sulphate daily, in 2 doses. The

TABLE 1

CASES TREATED WITH QUININE ONLY

Case No.	1 Day	2 Days	3 Days	4 Days	5 Days	6 Days	7 Days	8 Days	9 Days	10 Days	11 Days	12 Days
1	○++	○+	○+	—	—							
3	○+(+	○+(+	○+(+	—	(+	(+	?	(+	(+	(+		
5	○++	○++	—	—	—	—						
7	○+++	○+(+	○+(+	(+	(+	(+	?	(+	(+	(+	(+	(+
9	○+	○+	—	—	—	—						
11	○+	○+	—	—	—							
13	○+	?	○+(+	(+	(+	(+	(+	(+	(+	(+		
15	○+	○++	○+	—	—							
17	○++	○+	○+	—	—							
19	○++	○+(+	(+	(+	(+	(+	(+	(+	(+	(+	*Cont.*	*see*
21	○+	?	○+	○+(+	(+	(+	—	—			*Table*	*3*
23	○+	○+	○+	—	—							
25	?	○+	○+	○+	—	—	—					
27	○++	○+	○+(+	(+	(+	(+	—	(+	(+	(+	(+	
29	○++	○++	○+	—	—							
31	○++(+	○++(++	○+(+	(++	(++	(+	(++	(++	(++	(++	(++	
33	○+++	○+++	○+	○+	—	—	—					
35	(++	(++	(+	(+	(+	(+	(+	(+	(+			
37	○++	○++	○+	○+	○+	—	—	—				
39	○++	○+	—	—	—							
41	○+	—	?	?	—							
43	○++	○+	(+	(++	(++	(+	(+	(+	(+	(+	(+	(+
45	○++(+	○+(+	(+	—	(+	—	—	—				
47	○++	○++	○+	—	—	—						
49	○++	○+	○+(+	—	—							
51	○+(+	○+(+	(+	(+	(+	(+	(+	(+	(+			
53	○+++	○+++	○+	○+	—	—	—					
55	○+	○+	(+	(+	?	(+	(+	(+				
57	○++	○++	○+	—	—							
59	○+(+	(+	(+	(+	(+	(+	(+	(+				
61	○+++	○+++	○+++	○+	(+	—	(+	(+	(+	(+	(+	(+
63	○++	?	○+	○+(+	○+	—	—	—				
65	○+(++	○+(++	(++	(++	(++	(++	*Cont.*	*see Ta*	*ble 3*			
67	○+	○+	—	—	—							
69	○++	○++	○+	○+	—	—	—					
71	○+++	○+++	○+	—	○+	—	—	—				

○+ = 5 rings and less
○++ = 5 to 50 rings
○+++ = more than 50 rings
(+ = 2 crescents and less
(++ = more than 2 crescents
— = negative
? = not examined
} to one field

TABLE 2

CASES TREATED WITH PLASMOCHIN COMPOUND

Case No.	1 Day	2 Days	3 Days	4 Days	5 Days	6 Days	7 Days	8 Days	9 Days	10 Days	11 Days	12 Days
2	O++	O++	(+	(+	(+	(+	(+	(+	—	—		
4	O++	O+(+	(+	(+	(+	—	?	—				
6	O+	O+	O+	—	?	—	?	—				
8	O+++	O++	O+	(+	(+	(+	died					
10	O++	O++	O+	—	—	—	?	—	—			
12	O+	O+	(+	(+	?	—	—					
14	O+	—	—	—	—	—						
16	O+(+	O+(+	—	—	—							
18	O+(+	O+	—	—	?	—						
20	O+	O+	O+(+	O+(+	(+	—	—	—	—			
22	O++	O++	—	—	—	—						
24	O+	?	—	—								
26	?	O+(+	O+(+	O+(+	—	—	—					
28	?	O+(+	O+(+	(+	(+	(+	(+	—	—			
30	O+	(+	(++	(+	(+	(+	(+	(+	—	—		
32	O++(+	O+(+	(+	(+	—	—	—	—	—	—	—	
34	O+(+	O++(+	(+	—	—							
36	O+++	O+++	O+	O+	—	—	—					
38	O+(+	(+	(+	—	—							
40	(+	O+(+	(+	(+	(+	(+	—	—				
42	O+++	?	?	(+	(+	(+	(+	(+	(+	—	—	—
44	O+++	O+	(+	(+	—	?	—					
46	O++	O++	O+	O+	—	—	—	—				
48	O+	O+(+	(+	(+	(+	—	—					
50	(+	?	(+	—	—	?	?	—				
52	O++(+	O+(++	(++	(+	(+	(+	—	—	—			
54	O+	O+	?	(+	(+	(+	(+	(+	—			
56	O++	O+(+	O+(+	O+	—	—						
58	O+	O+	O+	O+	O+	O+	—	—	—			
60	O+	O++	—	—	—							
62	O+(+	O+(+	O+(+	—	—	—						
64	O++	O+++	O++	O+	O+	—	—	—				
66	O+	O+(+	(+	(+	—	—						
68	O+	O+	—	—								
70	O++	O++	O+	—	—	—						
72	O++	O+	O+	—	—							

O+ = 5 rings and less
O++ = 5 to 50 rings
O+++ = more than 50 rings
(+ = 2 crescents and less } to one field
(++ = more than 2 crescents
— = negative
? = not examined

other group of even Nos. 2, 4, 6, 8, etc., received 4 pills of plasmochin compound, twice daily. One pill contains 0.125 gram of quinine, plus 0.01 gram of plasmochin, so the daily dose was 1 gram of quinine plus 0.08 gram of plasmochin. The blood of each patient was examined every day (thick-drop method, Giemsa stain, 3 minutes' search) to check the presence of ring forms and crescents. The patients, with a few exceptions, were Haitian and Jamaican laborers from low, malaria-infected areas. It was therefore impossible in most cases to decide whether we were dealing with a primary infection, a relapse, or a reinfection.

Results, as regards blood findings, are shown in Tables 1 and 2 (pages 68 and 69).

Thirty-six patients were treated with quinine only. Time of observation varied between 5 and 12 days. In 17 of them crescents developed under observation; and on the 8th day of the treatment and afterward, 13 of them still carried crescents. In 4 cases the blood was negative for crescents after 3, 4, 5, and 6 days, respectively.

Thirty-six patients received plasmochin compound. Time of observation varied from 4 to 12 days, and crescents developed in 23 of them. Crescents were found only once or twice in 6 of them. In 16 cases of this group, crescents disappeared in from 3 to 7 days. In one case crescents were still present after 8 days' treatment with plasmochin compound.

All plasmochin cases were discharged from the hospital with negative peripheral bloods, whereas 11 of the quinine group were discharged with the peripheral bloods positive for crescents. The effect of plasmochin could be well demonstrated in Cases 19 and 65 (see Table 3, p. 71) who were treated first with quinine for 10 and 6 days, respectively. As crescents persisted in the blood without visible change in number, plasmochin was given. In both cases, crescents disappeared after 4 days of treatment. Case No. 65 had constantly 3 to 4 crescents to a field. The number dropped on the 3rd plasmochin day to 1 to a field, and on the 4th day it was difficult to find one.

These results are in accordance with Mühlens' statement that plasmochin has a decided influence on the circulation of crescents in the peripheral blood. That plasmochin is able to prevent the formation of crescents could not be demonstrated. It must be kept in mind that in this locality we rarely have to deal with clear-cut, acute, initial malaria infections. In 11 cases of the plasmochin series crescents were present in the peripheral blood on admission to the hospital. The majority of the cases admitted to our hospital are either relapses or acute infections engrafted on a chronic.

The general clinical course (disappearance of fever and ring forms) did not show a distinct difference in the two groups. The number of observations we are reporting on, however, is too small to justify a definite opinion as to the action of plasmochin on the clinical symptoms of malaria.

Case No. 8 of the plasmochin group died during treatment. This patient was admitted to the hospital with a severe infection and jaundice. On the 5th day he became somnolent, the jaundice increased, and the haemoglobin dropped to 35 per cent. Similar symptoms, but in milder form, occurred in 3 other patients. These cases will be the subject of a special publication. Mühlens describes cyanosis of a transient character as a complication of plasmochin treatment. This symptom was observed in 2 white patients of our series.

As little is known at present about the toxic effects of plasmochin, it is advisable that the drug be given only under strict medical supervision.

CONCLUSIONS

1. Plasmochin has a decided influence on the gamete forms of aestivo-autumnal malaria. They disappeared from the peripheral blood in the majority of our series in from 3 to 7 days of plasmochin treatment.
2. Plasmochin may play an important part in preventing the spread of malaria.
3. Toxic symptoms developed in 4 of our series while under plasmochin treatment.

TABLE 3

CASES TREATED WITH QUININE AND PLASMOCHIN COMPOUND

No. of Days	Case No. 19		Case No. 65	
1	quinine	O++	quinine	O+(++
2	“	O+(+	“	O+(++
3	“	(+	“	(++
4	“	(+	“	(++
5	“	(+	“	(++
6	“	(+	“	(++
7	“	(+	plasmochin	(++
8	“	(+	“	(++
9	“	(+	“	(+
10	“	(+	“	(+
11	plasmochin	(+	“	—
12	“	(+	“	—
13	“	(+	“	—
14	“	(+		
15	“	—		
16		—		
17		—		

REFERENCES

1. *Arch. f. Schiffs u. Tropenhyg.*, Beihefte Vol. xxx, No. 3
2. *Am. Journ. Trop. Med.*, Vol. VII, No. 1, Jan., 1927
3. *Menses Handbuch der Tropenkrankheiten*, Vol. III, (p. 47)

A DEATH IN A CASE OF MALARIAL FEVER UNDERGOING TREATMENT WITH PLASMOCHIN COMPOUND*

Preston Hospital, Cuba

CLINICAL NOTES BY DR. WILHELM CORDES

The patient was a male negro, 35 years of age. He was admitted suffering from a severe attack of aestivo-autumnal malaria and was treated with the new drug, plasmochin compound. On the 4th day of this treatment, after the fever had disappeared and the blood film was negative for malarial parasites, he developed a profound anaemia, leucocytosis, jaundice, nausea (vomiting), and somnolence. The urine was negative for haemoglobinuria. He died within 48 hours of the onset of this sudden attack. The toxic influence of plasmochin compound was suspected to have played an important rôle in the cause of death.

MICROSCOPIC EXAMINATION BY DR. F. B. MALLORY (U.F.A. 75)

Heart. — Negative.

Spleen. — Numerous lymphocytes and plasma cells in the pulp; many endothelial leucocytes in the blood sinuses containing red blood corpuscles, often in great numbers (10 to 20 and more). Malarial pigment occurred occasionally in the red blood corpuscles both free and in phagocytes.

Liver. — Endothelial cells lining sinusoids were prominent, occasionally phagocytic, and some contained pigment. Some of the liver cells in the centers of the lobules contained vacuoles in which were dots and occasionally threads of fibrin (hydropic degeneration). Rarely a liver cell was necrotic and was being invaded by endothelial leucocytes. There was slight lymphatic infiltration of periportal connective tissue.

Kidney. — Moderate oedema of the tubules.

Cerebrum. — Negative.

MICROSCOPIC DIAGNOSES

Malarial infection of the spleen.
Marked phagocytosis of red blood corpuscles in the spleen.
Early stage of central necrosis of liver lobules.

REMARKS

It is unfortunate that no bone marrow was included with the other tissues. The anaemia may have been due to destruction of red blood corpuscles by the malarial infection. The phagocytosis in the spleen would seem to indicate this. The beginning necrosis of the liver cells is probably due to the toxic action of the plasmochin, but it is not nearly so active as chloroform or carbon tetrachloride. Possibly plasmochin has a destructive effect on the red blood corpuscles.

---

* This is a case from the series treated by Dr. Cordes.

EXPERIENCES IN ALMIRANTE HOSPITAL

Dr. O. T. Brosius, of Almirante Hospital, Panama, reports as follows:

This report deals with a series of 58 cases that were under observation for from 6 to 28 days. The series was divided into 2 groups: those treated with plasmochin compound (26 cases), and those treated with plasmochin (32 cases).

The plasmochin compound series was under observation for from 6 to 28 days, or an average stay of 17 days.

The plasmochin series was observed from 5 to 25 days, or an average period of 16 days.

Plasmochin Compound. — There were 25 cases of aestivo-autumnal malaria and 1 case of mixed aestivo-autumnal and tertian malaria. The degree of infection found in the 26 cases was listed as follows: 5 light, 17 moderate, and 4 heavy.

Plasmochin. — This series included 29 cases of tertian and 3 cases of aestivo-autumnal malaria. Of these cases, 6 represented light, 24 moderate, and 2 heavy infections.

Below is a table showing the number of days during which various cases took the plasmochin compound and the plasmochin, respectively.

No. of Days Cases Took the Drug	Plasmochin Compound	Plasmochin
5	2 cases	2 cases
6	4 "	1 "
7	1 "	4 "
8	2 "	1 "
9	4 "	9 "
10	7 "	6 "
11	5 "	4 "
12	——	4 "
13	——	1 "
14	1 "	——

The size and number of the doses employed daily in administering these two drugs conform to the instructions given on page 38 and following of this Annual Report.

Here follows a table showing cases that received other drugs also:

OTHER DRUGS ADMINISTERED DURING PLASMOCHIN TREATMENT

Drugs	Plasmochin Compound	Plasmochin
Chenopodium	8 cases	10 cases
914	2 "	0 "
Sodium salicylate	1 "	0 "
Antivenin, bothropic . .	0 "	1 "

Below are listed certain associated conditions, with the number of cases:

ASSOCIATED CONDITIONS

Uncinariasis	19
Syphilis	3
Ascariasis	1
Operation for inguinal hernia	1
Pregnant, 4 months	1
Snake-bite poisoning	1
Abscess (location not stated)	1
Lacerated wound (location not stated)	1
Myalgia	1
Pyelitis	1

Daily examinations of thick blood films were made during the first 6 days, and thereafter a large number of blood films were examined, but not daily. All but 5 of the 58 cases had blood film examinations on the day of discharge from the hospital. No blood films examined after the 4th day of treatment revealed parasites in any of the cases.

SUMMARY

One of these cases returned with fever and with aestivo-autumnal parasites in the blood exactly 2 weeks after discharge. On this former admission a diagnosis of tertian malaria was made. There is the question of mixed malaria fever with a relapse to be considered here, or the possibility of the patient's having acquired a new infection. This man had been treated with plasmochin during the first 5 days of his previous admission; then he had no treatment for 5 days; then plasmochin treatment for 4 additional days. His total stay in the hospital had been 17 days.

Another patient (in the hospital for 19 days) was treated with plasmochin compound 5 days, rested 4 days, and was again treated for 4 days. The case remained 6 days after the last dose was given, and the blood was negative at the time of discharge. This case was readmitted exactly one month after his first admission. Just 5 days before this attack, a blood film was examined and found negative.

Cyanosis occurred during the course of treatment in 1 case of the plasmochin series.

A rapid reduction in the size of the spleen was noted following the use of either plasmochin compound or plasmochin.

There were 22 patients in this series of 58 cases who required treatment for associated conditions, and the 4 classes of drugs already mentioned were used during the general course of the plasmochin treatment, without apparent ill effects.

We have used plasmochin compound in successive daily doses in 3 cases for 7, 8, and 12 days with no ill effects.

A girl 12 years of age was given adult doses for 5 days, rested 4 days, and was then treated again with adult doses for 4 days. She showed no ill effects from the course of treatment.

A patient was admitted who had been on quinine for 19 days, and whose blood still revealed crescents. He became negative for parasites after 4 days of treatment with plasmochin compound.

We have had no one complain of gastralgia. All of our patients state that they have experienced from this drug none of the usual ill effects associated with quinine—such as deafness, dizziness, weakness, and tinnitus aureum, as well as the bitter taste.

EXPERIENCES IN QUIRIGUA HOSPITAL

Dr. N. P. Macphail, of Quirigua Hospital, Guatemala, reports as follows:

Since recently receiving these two new remedies at Quirigua, we have been able to use them in the treatment and observation of only 17 cases of malaria. These patients were under our care for from 1 to 3 weeks.

They were classified according to the species of parasites found on admission to the hospital: 9 aestivo-autumnal, 6 tertian, 1 quartan malaria, and 1 mixed aestivo-autumnal and tertian malaria.

Gametes were found in 11 of these cases on examination of the first blood film; 6 were crescent carriers.

All of these cases recovered from their attacks of malaria. The temperatures fell to normal not later than the 4th day and remained normal in all cases.

We cannot offer any statements concerning the possibility of relapse in these patients, since no case of the series was observed later than the 3rd week following the institution of the special treatment.

In each case a thick blood film was examined on admission. Thereafter the cases with severe symptoms were examined daily, and the others every 2nd day during the course of treatment.

The parasites disappeared from the peripheral blood between the 2nd and the 5th day after the treatment was begun.

One case in which we did not see gametes in the earlier examinations developed crescents during the course of treatment. These may, however, have been present in the peripheral blood in such small numbers that they were missed.

We reserved the use of plasmochin compound for the cases of aestivo-autumnal malaria and the mixed infections in which this species appeared.

Plasmochin (without quinine) was given to the cases that appeared, from our examinations, to be pure tertian and quartan infections.

Administration of Plasmochin Compound. — We gave 3 tablets (0.03 gm.) twice daily to those adults whose infections seemed to be of a light or moderate degree, while the heavy infections received 4 tablets (0.04 gm.) twice daily.

We gave 10 and even 11 tablets on a single day to 2 cases. It should be stated that in one of our very heavily infected cases we gave an intramuscular dose of 15 grs. of quinine on admission, to assist in gaining a prompt control of the infection. A second case of this same character received a similar treatment on the 1st and 2nd days of hospitalization.

Administration of Plasmochin. — We gave 2 tablets (0.04 gm.) twice daily to adults. No quinine was used in conjunction with this treatment.

One of our patients, a child 6 years of age suffering from a severe aestivo-autumnal infection, had been treated with quinine 3 grs. twice daily for 2 weeks, and then 4 grs. twice daily for an additional week. During this period of 3 weeks, it had also received 7 injections of quinine (5 grs. each). The blood thick film at the end of this period was positive for many crescents. This patient was then placed on 1 tablet of plasmochin compound thrice daily. No crescents or other parasites could be found after the 5th day.

Another child, 4 years of age, had been given quinine 3 grs. twice daily for a week, and at the end of that time a course of 4 intramuscular injections of quinine (5 grs. each) were given, in addition to the quinine that was being given by mouth. At the close of the 10th day's treatment the blood film still revealed rings and crescents in fair number. This case was then placed on plasmochin compound, 1 tablet thrice daily. No parasites were found after the 3rd day.

SUMMARY

We find that plasmochin and plasmochin compound are especially efficacious in the management of gamete carriers.

Cyanosis occurred in a single case of the plasmochin series when it had been under treatment for one week. This patient was very anaemic and had an aortic murmur.

It was difficult to collect data regarding the reduction in size of the spleen during the course of treatment, because most of our adults show a chronic enlargement of the spleen. We did note, in children, a rapid reduction in its size.

The parasites disappeared, in all of our cases, by the end of the 5th day.

Gametes (crescents) were found in one case near the close of the course of treatment, in which we had not seen crescents in the earlier blood film examination.

We are not prepared, from the short observation on these few cases, to make any prediction in regard to the possibility of relapses in these people.

At the present time, it seems wise to treat vigorously with quinine on the first day of admission those cases that are in a very serious condition. This initial treatment can then be followed by the use of plasmochin or plasmochin compound.

EXPERIENCES IN THE HOSPITAL OF TELA RAILROAD COMPANY

Dr. R. B. Nutter, of Tela Railroad Company Hospital, Honduras, reports as follows:

All adults in this series were given 2 tablets three times daily of plasmochin compound (0.01 gm. plasmochin and 0.125 gm. dry quinine sulphate).

These 29 cases of malaria were associated in 4 instances with pregnancy, 3 times with syphilis, once with taeniasis, and twice with major abdominal operations. Two of the patients had taken courses of quinine. One patient was only 16 months old, but 2 plasmochin compound tablets were given daily.

Classified according to the species of parasites found, these cases were as follows:

Parasites	No. of Cases
Aestivo-autumnal	21
Aestivo-autumnal and tertian	4
Quartan	2
Aestivo-autumnal and quartan	1
Tertian	1

Only 2 cases remained positive for malarial parasites (crescents) after the 7th day of treatment.

Case 7,834* was a child 4 years of age. It was given 1 tablet of plasmochin compound 3 times during the 1st day. At the end of 24 hours the temperature rose from 103° F. to 105°, and the child was so sick that plasmochin compound was discontinued and quinine treatment substituted. The quinine was given, 10 grains a day, until the time of discharge from the hospital. The patient's blood film, upon discharge, was positive for crescents (the 10th day under treatment).

Case 7,738 had been admitted twice in the last 2 months for a very heavy infection of aestivo-autumnal malaria. She was pregnant and had been taking quinine and haematic pills. Syphilis was also present (Kahn test ++++), and she had been given 6 neosalvarsan treatments during the past 2 months. The films made from the placenta in this case were positive in a plus manner for aestivo-autumnal parasites. The peripheral blood of this patient was free from parasites 6 days after treatment with plasmochin compound.

Case 7,775 was a maid employed in the hospital, who had been suffering for 2 months from malaria, a mixed aestivo-autumnal and tertian infection. She would never take more than 10 grains of quinine daily. We placed her on the plasmochin compound, and on the 5th day of this course of treatment she developed an icterus and had a slight haemoglobinuria for 24 hours. The treatment was not interrupted. Her blood films were negative for parasites on the 5th, 7th, 9th, and 11th days, the only days that the blood was examined following the date of her admission.

DISCUSSION

Four patients in the series were in various stages of pregnancy, ranging from the 3rd to the 7th month. No sedative was given, and in no instance did uterine contractions occur that we could consider due to the action of plasmochin compound.

---

* This case did not receive a course of plasmochin treatment.

Two patients, upon close questioning, stated that they felt slight nausea for a few minutes after each dose. No cyanosis, prostration, or vomiting was observed.

From my observation of these few cases, I can see no objection to issuing plasmochin compound for treatment outside the hospital. It seems particularly desirable in cases of pregnancy and in patients with disease of the ear.

Dr. E. J. Whitaker, of Tela Railroad Company Hospital, Honduras, reports as follows:

Plasmochin, without quinine in any form, was administered for a period of 4 days to 30 cases of malarial fever. At the close of the period of treatment, malarial parasites were present in 19 of these cases, or 63.3 per cent of the series.

Plasmochin, without quinine in any form, was given over a period of 6 days to 24 cases of malaria. At the close of this course of treatment, there were 14 cases, or 58.3 per cent, which still showed parasites in their blood.

The result of the treatment, according to the species of parasites found in the 54 cases, was as follows:

> Forty-seven cases of aestivo-autumnal malaria were treated, and 29 of them (61.7 per cent) continued to show parasites in their blood films, 6 of them revealing crescents.
>
> Three cases of mixed malaria, aestivo-autumnal and tertian, were given the course of plasmochin and 1 (33.3 per cent) continued to show parasites in the blood, both ring and crescent forms.
>
> Three cases of tertian malaria were all positive for parasites at the close of the course of treatment.
>
> One case of quartan malaria also remained positive for parasites, following the treatment.

I gave 21 of the cases 5 tablets (0.02 gm.) of plasmochin daily, and cyanosis or epigastric pain occurred in 9 of the patients, or 42.8 per cent.

The remaining 33 cases were then given 4 tablets (0.02 gm.) of plasmochin daily. There were only 2 of these patients who developed cyanosis or epigastric pain.

The total number of crescent carriers at the close of treatment of the entire series of 54 cases was 7. The cases treated over the 4-day period yielded 2 crescent carriers, and the cases treated for 6 days yielded 5 crescent carriers. An analysis based on the actual number of tablets given daily shows the following:

Cases given 4 tablets daily showed 4 crescent carriers.
Cases given 5 tablets daily showed 3 crescent carriers.

DISCUSSION

This series of cases is too small to warrant drawing definite conclusions, but a few remarks, at least, may be made on the subject.

The tablets are easy to give and are generally retained.

Cyanosis, epigastric pain and, at times, vomiting were caused in too large a percentage of the cases treated with 5 tablets daily as is recommended by Mühlens. When the dose was reduced to 4 tablets daily, these results were infrequent. Several of the cases with cyanosis and epigastric pain were very sick.

Crescents and also tertian parasites in several cases showed great resistance to the drug, and this is contrary to expected results.

I have the impression that the general improvement following the treatment was not as apparent as under quinine treatment, although, seemingly, the fever was controlled just as well. Plasmochin will not supplant quinine in the Tropics, but it may prove a valuable adjuvant when used with that drug.

RECAPITULATION

The use of plasmochin and plasmochin compound in the various forms of malarial fever is summarized in a tabular manner below:

Species of Parasites in the Cases	Treated with Plasmochin Comp.	Treated with Plasmochin	Total No. of Cases
Aestivo-autumnal	91	50	141
Aestivo-autumnal and tertian . . .	6	3	9
Aestivo-autumnal and quartan . . .	1	0	1
Tertian	1	38	39
Quartan.	2	2	4
Totals	101	93	194

The Preston (Dr. Cordes') experience with plasmochin compound offers an excellent detailed report, and it can be used to show in a graphic manner what has been the average experience in the use of the new drug:

Drugs Used in the Series (36 cases in each series)	Gametes Found First Day or So after Admission	Gametes Found on 8th day of Treatment	Cases Positive for Gametes on the Day of Discharge
Quinine control series	47.2%	36.1%	30.5%
Plasmochin compound series	63.8%	2.7%	0.0%

The results obtained by Dr. Whitaker, of Tela, following the use of plasmochin (without associated quinine treatment) indicate unfavorable conditions at the end of 4-day and 6-day courses of treatment. The course was not repeated in these cases. All the other reports received regarding plasmochin or plasmochin compound indicate a disappearance of all forms of the parasites within from 3 to 8 days; usually parasites were not found after the 4th day of the first course of treatment.

Prevention of Gamete Development. — There were two cases under treatment that did not reveal gametes in the peripheral blood during the early days of treatment, and yet they did show a few gametes late in the course of their treatment. It is a debatable question whether these gametes developed during this period of treatment, or whether they had been present from the beginning of the course of treatment in such small numbers that they were not found in the earlier examinations.

Disappearance of Fever and Symptoms. — Generally speaking, the results were the same in regard to these two features, whether the course of treatment had been quinine, plasmochin, or plasmochin compound.

Reduction in Size of the Spleen. — This seems to have occurred more rapidly under the influence of plasmochin or plasmochin compound than it did when quinine was the treatment. The rapid reduction in the size of this organ was commented on with greater emphasis in the case of children than in the case of adults.

Relapses. — None of the reports we have received can give us much information on this important subject, because all the series were under treatment and observation for only a short period. The negative state of the peripheral blood films on the date of discharge does not necessarily reflect the entire story regarding the possible presence of gametes in the deep viscera, and furthermore the opportunity for reinfection is ever present in the labor-camp environment. The report from Dr. Brosius certainly suggests very strongly the possibility of relapse in two of his cases.

Refractory Cases under Quinine Treatment. — It is most encouraging to note the prompt effects of plasmochin compound in the number of cases reported as refractory to the influence of quinine treatment, even when quinine had been given in an intensive manner over a long period.

Results of Continuous Administration of Plasmochin. — Dr. Brosius reports that he gave the drug on successive days to 3 cases over periods of 7, 8, and 12 days, and that he did not note a harmful result in any of the cases. He also treated a girl of 12 years with adult doses without noting untoward results.

Plasmochin in Pregnancy. — Dr. Nutter's experience in Tela indicates a highly important field of usefulness for the new drug. Malaria is very frequently a complication of the late stage of pregnancy, and many hesitate to use effective quinine dosage under such circumstances.

Unfavorable Results from the Use of Plasmochin. — One death occurred in which the toxic effect of the drug may have played an important rôle.* Three additional cases developed similar clinical pictures but they recovered; 4 cases developed cyanosis; 11 cases developed cyanosis or epigastric pain; 1 case developed haemoglobinuria, but this feature disappeared within 24 hours.

---

* See Dr. Mallory's pathological report (page 72).

Consensus of Opinion Regarding Plasmochin. — As a rule, it was easy to give, was well retained, and the patients preferred it to quinine. Dr. Brosius sends us the report of a case under treatment with plasmochin compound that had passed a tablet of this drug which was quite unchanged in form. The drug was not absorbed in this patient until the tablets were given in a crushed state. All opinions that have been expressed regarding plasmochin (without quinine), except one, have been favorable in so far as a short course of treatment can be taken as an index of success.

Some members of the staff appear to think that the new drug should be given only under the close supervision of a hospital staff, while others believe it safe to prescribe it in the dispensary and office practice.

Most of these reports appear to favor one or more days of intensive treatment with quinine in the very severe hospital cases of malaria before placing them on plasmochin or plasmochin compound. The latter appears to be much more popular and successful than plasmochin alone, and it also seems to be less often accompanied with unfavorable toxic effects. It certainly appears to accomplish the destruction of the gametes in a very short period if a negative peripheral blood film can be assumed to reflect the degree of parasitism in the deep viscera.

The administration of the drug has certainly been attended in a few individuals with alarming manifestations.

Our brief experience justifies the conclusion that *plasmochin compound* is an exceedingly valuable therapeutic agent in the treatment of malaria and in the prevention of its spread.

We recommend that the blood films of all cases of malaria under treatment in the hospitals and in the hospital dispensaries be examined by the thick film method before discharge and, if parasites remain, that a course or courses of plasmochin compound be repeated until the peripheral blood is found to be negative.

SECTION III

REMARKS ON THE DIAGNOSIS OF INTESTINAL AMOEBIASIS

W. M. JAMES, M.D., F.A.C.P.

Intestinal amoebiasis, due to various degrees of ulceration of the large bowel and rectum following infection with *E. histolytica*, is a very common ailment throughout those parts of the Caribbean littoral where the United Fruit Company maintains hospitals. A survey of the reports of the Medical Department of the Company for the past ten years shows that the acute phase of this infection, amoebic dysentery, is prevalent and very generally distributed; and where this is true, there is inevitably a large proportion of infection, that, while dysentery is not active, produces all manner of symptoms referable to the gastro-intestinal tract, and at times abscess of the liver and even more serious complications.

Following a small and local epidemic of amoebic dysentery in 1925, in Santa Marta, Colombia, confined mostly to American employees, a survey was made by Kofoid, Swezy, Boyers,[1] and James[2] (1925), which uncovered approximately 60 per cent of histolytica infection among the American employees; a very high percentage of those infected complained of more or less "stomach trouble."

An interesting feature of this survey was that wet fixed and stained preparations (which hereafter, for convenience, I shall designate as permanent preparations) were made from nearly all stools in which amoebae of any type were found, as well as from stools in suspicious cases. Through the courtesy of Drs. Kofoid and Swezy, I received a nearly complete set of these permanent preparations, and also a list of the findings in the fresh specimens. It is true that not as much study was given to the fresh as to the permanent preparations, for reasons noted at that time, but it was predicted then (1925) that the permanent preparations would show a higher percentage of positive findings than would the fresh. Dr. Kofoid has not as yet published a correlation between these two classes of findings, and it is possible that the relatively limited study of the fresh preparations affects adversely their evidential value. None the less, most of them were carefully gone over by Dr. Kofoid or myself, and at least as much time was devoted to studying them as is usually spent in a routine stool examination. In checking my own findings in the fresh specimens against the permanent preparations made by Dr. Swezy and, in some instances, by myself, the increase in positives of all classes of amoebae in the permanent preparations was decidedly evident.

Following the International Conference on Health Problems in Tropical America, which was held in Kingston, Jamaica, in 1924, I made permanent preparations from a series of stools with positive protozoological findings, and sent them to various recognized authorities. My intent was to find out if such authorities would be in substantial agreement as to the findings, and also to check my own work for errors in interpretation. In all, 50 slides from about 40 cases were sent out, and findings were received from Dr. C. M. Wenyon; Dr. R. W. Hegner, (mostly by his technical assistant, Mr. Conrad Bauer); Captain J. H. St. John and Major P. A. Schule, of the U. S. Army Medical School; and Dr. Frank G. Haughwout, of The Bureau of Science Laboratory, Manila, P. I., who was the last one to whom slides were sent. The fresh preparations corresponding to these slides I had personally subjected to the usual routine examination, concerning which more will be said later.

It is obviously impossible to have one's own findings in fresh preparations checked by competent authority, except under unusually favorable circumstances, and even then sometimes there will be grounds for difference in interpretation. All of the findings, including my own in the fresh preparations, will be sent to Dr. C. M. Wenyon for correlation. I can, however, state at this time that, taking the findings in the permanent preparations as criteria, my percentage of error in the examination of fresh specimens, with especial reference to the occurrence of *E. histolytica*, was too high for accurate clinical work. There was, however, close agreement among all of us in this respect in our findings in the permanent preparations, although there were minor and relatively unimportant differences in the identification of the other amoebae. That is, they were unimportant from the clinical view, although the protozoologist might not, and probably would not, regard them as such.

In 1923 I had come to the conclusion that in the determinability of the prevalence of infection with *E. histolytica*, the examination of fresh specimens offered many pitfalls to the average observer such as myself.

I am indeed satisfied that under certain specific conditions—such as, for example, the almost perfect freshness of the specimen—the thoroughly trained and competent protozoologist, as Dobell[3] (1919) states, can differentiate accurately, in fresh material, between the five species of the intestinal amoebae of man. But these are not the conditions of clinical and laboratory work in the Tropics, and the qualified protozoologist is rarely found among us. There is other work for him to do, and he is busy doing it. The long record of oversights and misinterpretations (my own among them) and the resulting confusion, due to the earnest and well-meant but mistaken efforts of amateur protozoologists to confirm the findings of some great name, or to bring, as from out of Africa, some new organism in the study of intestinal amoebiasis, is ample proof of the difficulty of interpreting the findings in preparations made from unfixed and unstained stool material. Justly, indeed, does Dobell[3] (1919) remark (page 12):

> A present day seeker after the truth, completely ignorant of the subject, would obtain more reliable information by consulting the works published prior to 1900 than those which appeared during the next ten years.

If one works in areas in which *histolytica* infection is present, and wishes correctly to diagnose and treat the many varieties of "stomach trouble" which constantly present themselves, one must be prepared to recognize amoebae in the stools, and to differentiate *histolytica* from the three other species of amoebae commonly found, and frequently associated with it in the same stool, i.e., *E. coli*, *I. butschlii*, and *E. nana*. *Dientamoeba fragilis* is rarely encountered, but I might record here that I have twice observed it in considerable numbers, and on the fresh specimen both times mistook it for *histolytica*. There are certain phases of *Chilomastix*, *Trichomonas*, and one of the smaller flagellates that I have not successfully identified, which, not infrequently in fresh as well as in permanent preparations, also, bear more than a superficial resemblance to *histolytica*.

The truth is that the finding and the correct identification of *E. histolytica* in the stools has been no easy task in the past, nor is it such today. The record of errors is voluminous—I refer not so much to mistakes in biology as to those in the morphological criteria used as standards of identification.

Professor Clifford Dobell, F.R.S., was detailed in 1915, by the Medical Research Committee of England, to survey patients convalescent after dysentery, which work he later extended. His account[4] (1917) of the errors in examination should be read by every one interested in stool examinations. Thirty-seven workers accustomed to the use of the microscope, but untrained in protozoology, began work under the direction and training of himself and Dr. A. C. Stevenson. What happened is best stated in his own words (page 17):

> The errors committed by an examiner with little or no previous experience, are such as I could not have believed possible if I had not actually encountered them; and in cases where the health of a patient is at stake, it is, I believe, almost better that no examination at all should be made, than that it should be made by an incompetent or inexperienced person.

At the end of five weeks, five workers were classified as having obtained "considerable proficiency."

Dobell further proved the fallacy of depending on one stool examination, and showed that at least six should be made before pronouncing a patient free from protozoal infection.

Boeck and Stiles[5] (1923) state in their series the chances of not finding cysts in known *histolytica* infections were 2 to 1 at any one examination, but that these figures must be accepted with reserve, for it not infrequently occurs that cysts are not found until the fourth, fifth, sixth, or even xth examination.

As stated above, it is obvious that there must be a certain amount of intestinal amoebiasis among the United Fruit Company employees stationed in the Tropics. The symptomatology was discussed by James and Deeks[6] (1924) and this report is readily accessible to the physicians in various hospitals. A peculiarity of gastro-intestinal trouble due to *histolytica* infection is, that it is chronic and yields only infrequently and temporarily to dietetic and simple remedial measures. This infection frequently impairs materially the usefulness and efficiency of an employee, although his general health may be apparently but little affected. Continued gastro-intestinal discomfort leads to neurasthenia in many cases with resulting mental irritability and loss of concentration. When accompanied by long-continued loss of weight, it results in advanced gastro-enteroptosis, with all manner of unpleasant symptoms—a condition frequently seen in the Herrick Clinic at Panama, and one requiring much patience and time in its treatment. It is hoped, then, that any suggestions leading to facility and correctness in diagnosis may be helpful.

Survey figures show that one examination reveals about ⅓ of the actual number of *histolytica* infections present in a given community; 3 examinations, between ½ and ⅔; 6 examinations, up to about 90 per cent, while the remaining 10 per cent may require an indefinite number of examinations before the infection is found.

But it should be remembered that survey examinations for the most part are made on old stools and are not checked, as a rule, by permanent preparations. That is, the determination is made by finding cysts only in unstained or iodine-treated preparations. None of the survey figures show what the findings would have been, had reasonably fresh material been used and checked against permanent preparations. My own figures, to date, show that in about one-half of my *histolytica* infections, and excluding acute dysentery, only vegetative forms are found, and these would have been lost in survey work. Further, as above noted, there is, in suspected cases, an indeterminate, but a very definite, increase in the positive findings in permanent preparations over those in unstained material, whether fresh or old. Also, in infected districts such as the Caribbean littoral there will be a much higher percentage of positive findings than in any group in the United States or Europe. In Santa Marta, not only was there an extraordinary incidence of *histolytica* infection, but the individual infections themselves averaged much heavier than those seen in the Herrick Clinic in Panama, where patients come from all over Central America and Northern South America.

By using reasonably fresh material and by the study of permanent preparations made from this, I believe that in trained hands the percentage of positive findings in amoebiasis (not amoebic dysentery) can be raised on the first examination from the survey figures of 33 per cent to at least 75 per cent. This is due to the finding of vegetative forms which are lost in survey work. Thus the chance of a positive diagnosis on the first examination is raised from one in three to three in four. From my experience in my own work I would say that 60 per cent of my *histolytica* infections have been found on the first examination of fresh material, and about 75 per cent when this has been combined with permanent preparations, which is over twice as much as the survey figures show. The second examination, where the first has been negative, has increased this to 90 per cent.

To date, in the study of permanent preparations from some 250 patients, it has not been necessary for me to go beyond the third examination. By this I mean that if the third examination has not uncovered a positive *histolytica* infection, I have not found it in the fourth to the sixth or seventh examinations.

I have also made a series of control smears from apparently normal patients. When these were negative in the first three examinations, I did not find *histolytica* or other amoebae subsequently. It is, however, truly remarkable to see the variations in the number of amoebae that occur not only in *histolytica* infections but in those with the other species as well. On one day the amoebae will occur in great numbers and are easily found. On another day they will be uncovered only by a prolonged search in permanent preparations, and the fresh specimen will often be entirely negative.

A stool may be swarming with amoebae or cysts, or both, and a second stool passed a few hours later will contain but few. It is of considerable importance to select, as nearly as possible, material which will show the maximum amount of infection in any given case. The correct diagnosis of *histolytica* infection is not a mere routine laboratory procedure. It requires training, and not only training but patience and a reasonable degree of skill in the proper manipulation of the microscope. Many a laboratory man, who because he has used the instrument as one of the working tools of his profession for years, and has therefore come to fancy himself rather skillful in handling it, has been astonished to find the superior images obtained with his own lenses by another who really does know how to use the microscope. I do not write here of the refinements of the art of microscopy, but of intelligent use of its elementary principles.

Text books are useful, indeed indispensable, and I append to this article a list of references which will be of value to the student; but, as in many other fields, experience is the best teacher. The findings in fresh preparations must be checked against those in permanent ones, until the student is satisfied that his interpretations of the former are reasonably correct; I know of no other method of value for him, except personal instruction from a known authority. My own experience has been that errors both in teaching and in learning are far more frequent when this checking method is omitted and dependence is placed solely upon examination of fresh material.

Type slides of permanent preparations are useful enough for comparison with similar material, but they can not take the place of the study of fresh material checked against fixed and stained smears made at the same time. Undoubtedly the preparation of the smears is tiresome, and takes time, but it is no more difficult than routine histological and pathological work of other kinds. The problem, in tropical countries, is one of correct diagnosis of a common and often chronic disease of the large intestine, with protean symptomatology, and Dobell is correct when he states that if it can not be made properly, it should not be made at all.

To describe in detail the technique of making permanent preparations is outside the scope of this paper. For similar reasons no description of the amoebae is given, nor is any attempt made to differentiate between them, since this information is set down at length in the text books referred to at the end of this article. There is an old saying, "All signs fail in dry weather"; frequently in fresh preparations, and sometimes in permanent ones, the precystic stages of *coli* and *histolytica* can not be differentiated with certainty. In fresh specimens *butschlii*, *coli*, and *histolytica* are often mistaken one for another, and the small *nana* and *histolytica* are very similar indeed. It may be stated, there is one of the smaller flagellates which, in permanent preparations, is morphologically almost identical with the smallest type of vegetative *histolytica*, in nuclear as well as in cytoplasmic structure.

Various methods of obtaining suitable stool material have been recommended. Kofoid advocates the use of bile salts or of *fel bovis*, and this does give good results. In my opinion, a mild laxative will answer in most cases. The object is to obtain a soft stool, without purgation, since it is very difficult to make permanent preparations from liquid stools. Encystment of the amoebae does have some relation to formed stools, but only when the organisms are in that stage of their life cycle when encystment is about to ensue. Usually I give 2 or 3 Alophen pills, at about 11 or 12 o'clock at night, so that when the patient brings the stool in the morning it is fairly fresh. A stool that contains material from high up in the bowel, as well as from lower down, is the best for the purpose; and if, after the laxative, successive stools are formed, soft, and liquid, the patient should be instructed to bring a sample of each part.

If the first examinations are negative, either for any amoebae in general, or for *histolytica* in particular, it is always advisable, when possible, to wait two or three days before giving another laxative. As above stated, the number of amoebae found at any given examination varies widely; and it is my experience that the largest number is most frequently obtained following the administration of a mild laxative after one or two days of constipation.

It may be possible, in places where the staff is not equipped for the work, nor familiar with the technique, to prepare slides for examination elsewhere. This is done by fixing them for ten minutes in Schaudinn's fluid, which is composed as follows:

SATURATED SOLUTION OF BICHLORIDE OF MERCURY IN	
Normal salt solution	65 cc.
Ethyl alcohol 95%	35 cc.
Glacial acetic acid	3–5 cc.

This solution, if kept tightly stoppered, can be used many times, as Dobell has pointed out.

The material is painted thinly on the lower end of the slides with a camel's hair brush, or with cotton wrapped around a match or a toothpick; the slides are quickly placed in a Koplin staining jar containing the fixative. This must be done rapidly in order that the material may not have time to dry. After ten minutes the slides are transferred to 70% ethyl alcohol and, after ten minutes more, to 95% ethyl alcohol. After hardening in this last over night, they are placed one by one in a wide-mouthed glass containing 70% alcohol. As each slide is placed in the glass, a continuous piece of string is wrapped around its upper end, and the next slide is placed in position, and wrapped to the preceding one, so that five or six slides in a bundle are wound together tightly at the tops, separated from one another by the string, and with the bottoms free. Unless this precaution is taken, they will adhere, and the material will later rub off. Cover glasses are an unmitigated nuisance, and I prefer not to use them. After the bundle of slides is prepared, it is placed in a leak-proof container *filled* with 75% ethyl alcohol. The container is sealed with wax or paraffin, carefully protected by cotton or excelsior, packed in a *wooden* box, and forwarded to its destination, where the rest of the work can be done. I learned this method from Dr. C. A. Kofoid, and it is the best I know for the transportation of wet fixed material.

It must ever be borne in mind that the smears *can not be allowed even the slightest touch of drying*, else the nuclei of the amoebae are so distorted and broken up that identification is impossible.

REFERENCES

1. 1925, Kofoid, Swezy, and Boyers, in the 14th Annual Report, Medical Department, United Fruit Company, (p. 140)
2. 1925, James, W. M., in the 14th Annual Report, Medical Department, United Fruit Company, (p. 160)
3. 1918, Dobell, C., "A Study of 1,300 Convalescent Cases of Dysentery from Home Hospitals," Medical Research Committee
4. 1917, Dobell, C., "Amoebic Dysentery and the Protozoological Investigation of Cases and Carriers," Medical Research Committee
5. 1923, Boeck and Stiles, "Studies on Various Intestinal Parasites"
6. 1924, James and Deeks, "The Etiology, Symptomatology and Treatment of Intestinal Amoebiasis," *Proceedings of International Conference on Health Problems in Tropical America*, United Fruit Co., Boston, 1924

1919, Dobell, C., "Amoebae Living in Man"

1921, Dobell and O'Connor, "The Intestinal Protozoa in Man"

1924, Hegner and Taliaferro, "Human Protozoology"

1926, Craig, C. F., "A Manual of the Parasitic Protozoa of Man"

1926, Wenyon, C. W., "Protozoology"

THE CLASSIFICATION OF BACTERIAL DYSENTERIES AND OF DYSENTERY BACILLI

ALDO CASTELLANI, M.D., F.R.C.P.
Professor of Tropical Medicine
Tulane University of Louisiana, New Orleans

It is generally recognized that the present classification of bacterial dysenteries as well as of the dysentery bacilli is in a somewhat unsatisfactory position. I venture therefore to bring forward again a classification which I suggested some years ago, but which so far has attracted very little attention. This classification was followed to a great extent by Chalmers and myself in the third edition of our "Manual of Tropical Medicine."

According to the classification mentioned, bacterial dysenteries are separated into three groups:

1. *Bacterial dysentery, sensu stricto* (synonyms Shigadysentery, Shiga-Krusedysentery), due to dysentery organisms which do not ferment lactose or mannitol and do not clot milk (Shiga-Kruse bacillus).
2. *Paradysentery,* due to organisms which do not ferment lactose, ferment mannitol (acid only), do not clot milk (Flexner, Hiss-Russell, etc.).
3. *Metadysentery,* due to organisms which, as is the case with the true dysentery bacilli, do not produce gas in any sugar, but either ferment lactose (acid only) and clot milk, or ferment lactose (acid only) without clotting milk, or clot milk without fermenting lactose. (Organisms of the genus *Dysenteroides* and *Lankoides.*)

To make clear this grouping of bacterial dysenteries and dysentery bacilli, it is necessary to say a few words on the classification of the aerobic (facultative anaerobic) asporigenous, non-capsulated, gram-negative intestinal bacilli which do not liquefy gelatine or serum and do not produce pigment, viz., the tribe *Ebertheae* of Chalmers and myself. This tribe contains the organisms which are known usually as the typhoid-dysentery, alkaligenes, paratyphoid-Gärtner, Coli groups. The tribe *Ebertheae* was defined as follows by Chalmers and myself: "Bacillaceae growing well on ordinary media, not forming endospores; aerobes and often facultative anaerobes; without fluorescence, pigment formation or gelatine liquefaction; without polar-staining, gram-negative, without a capsule."

The tribe *Ebertheae* may be divided into two subtribes:

(a) The organisms do not produce gas in glucose or any other sugar—Subtribe *Eberthoanaerogeneae.*
(b) The organisms produce gas in glucose and usually in other sugars—*Eberthoaerogeneae.*

The first subtribe contains six genera:

1. *Alkaligenes* Castellani and Chalmers
2. *Vibriothrix* Castellani
3. *Eberthus* Castellani and Chalmers
4. *Shigella* Castellani and Chalmers
5. *Lankoides* Castellani and Chalmers
6. *Dysenteroides* Castellani and Chalmers

The second subtribe contains five genera:

1. *Salmonella* Lignières
2. *Wesenbergus* Castellani and Chalmers
3. *Enteroides* Castellani and Chalmers
4. *Balkanella* Castellani and Chalmers
5. *Escherichia* Castellani and Chalmers

These eleven genera can be easily differentiated by using three media: milk, lactose, and glucose.

1. Genus *Alkaligenes*—Milk not clotted, (no change in the reaction of the medium, or alkaline); Lactose, no gas, (no change, or alkaline); Glucose, no gas (no change in the reaction of the medium, or alkaline).
2. Genus *Vibriothrix*—Same reactions as *Alkaligenes*, but the organisms of this genus are very polymorphic, vibrio-like, spirillum-like, bacillus-like; all the different forms may be found in the same preparation; they probably belong to the Higher Fungi (see Castellani and Chalmers' "Manual of Tropical Medicine," 3rd edition, p. 1,068).
3. Genus *Eberthus*—Milk not clotted, Lactose no change, Glucose Acid, motility +.
4. Genus *Shigella*—Same characters as *Eberthus* but motility 0.
5. Genus *Dysenteroides*—Milk not clotted, Lactose Acid, Glucose Acid.
6. Genus *Salmonella*—Milk not clotted, Lactose no change, Glucose Acid and Gas.
7. Genus *Wesenbergus*—Milk not clotted, Lactose Acid, Glucose Acid and Gas.
8. Genus *Enteroides*—Milk not clotted, Lactose Acid and Gas, Glucose Acid and Gas.
9. Genus *Lankoides*—Milk clotted (very slowly), Lactose no change or slowly Acid, Glucose Acid.
10. Genus *Balkanella*—Milk clotted, Lactose Acid or no change, Glucose Acid and Gas.
11. Genus *Escherichia*—Milk clotted, Lactose Acid and Gas, Glucose Acid and Gas.

The differential biochemical characters of the above genera are summarized in Table I.

TABLE I

TRIBE EBERTHEAE

Genus	Litmus Milk	Lactose	Glucose	Remarks
Alkaligenes	O (Alk)	O (Alk)	O (Alk)	
Vibriothrix	O (Alk)	O (Alk)	O (Alk)	Same biochemical reactions as Alkaligenes but organisms are polymorphic, bacillus-like, vibrio-like and undulating filaments are often present in the same preparation. Probably belong to Higher Fungi (see Castellani and Chalmers' "Manual of Tropical Medicine," p. 1,068).
Eberthus	O	O	A	Motility present.
Shigella	O	O	A	Same biochemical reactions as Eberthus, but the organisms are non-motile.
Dysenteroides	O	A	A	
Salmonella	O	O	AG	
Wesenbergus	O	A	AG	
Enteroides	O	AG	AG	
Lankoides	C (slowly)	O or A	A	
Balkanella	C	O or A	AG	
Escherichia	C	AG	AG	

O = Negative, viz., absence of clotting in milk, absence of acidity and gas in sugar media
A = Acid
AG = Acid and gas
Alk. = Strongly alkaline
C = Milk clotted

Key for the Identification of the Genera of the Tribe Ebertheae

The following key may be found useful for the generic identification of intestinal organisms of the tribe *Ebertheae*, viz., non-capsulated, gram-negative, non-sporigenous bacilli which grow well on agar, are aerobic (facultative anaerobic), do not produce pigment, do not liquefy gelatine or serum.

TABLE II

KEY TO THE GENERA OF THE TRIBE EBERTHEAE

(So-called Alkaligenes, Typhoid-Dysentery, Paratyphoid, Coli Groups of Bacteria)

- EBERTHEAE—GAS IN GLUCOSE (Intestinal, non-capsulated bacilli which are aerobic [facultative anaerobic], grow well on agar, do not produce pigment, are non-sporigenous, non-bipolar staining, gram-negative, gelatine and serum not liquefied.)
  - Gas absent (O) SUBTRIBE EBERTHOANAEROGENEAE—MILK
    - Not clotted—Acidity in glucose
      - Absent (O or Alk)
        - bacillus, Alkaligenes
        - pleomorphic (bacillus, vibrio, spirillum) Vibriothrix
      - Present (A)—Lactose
        - O, motility
          - +, Eberthus
          - O, Shigella—Mannitol
            - O, Dysentery type *sensu stricto*
              - Shiga-Kruse
            - A, Paradysentery type—maltose
              - A, Flexner type
              - O, Y (Hiss-Russell type)
        - A, Dysenteroides
    - Clotted, Lankoides
  - Gas present (+) SUBTRIBE EBERTHOAEROGENEAE—MILK
    - Not clotted—Lactose
      - O, Salmonella—Maltose
        - O, Morgan group
        - +, Saccharose
          - O, Paratyphosus group *sensu lato*
          - +, Asiaticus group
      - A, Wesenbergus
      - AG, Enteroides
    - Clotted—Lactose
      - A or O, Balkanella
      - AG, Escherichia—Saccharose
        - +, Section communior
        - O, Section communis

O = Negative result, viz., absence of clotting in milk, absence of acidity and gas in sugar media
+ = Positive, viz., presence of clotting in milk, presence of acid and gas in sugar media
A = Acid
G = Gas
AG = Acid and gas
Alk. = Strongly alkaline

Classification of the Dysentery Bacilli. — The dysentery bacilli, according to the classification of Chalmers and myself, belong to the following three genera: *Shigella, Dysenteroides, and Lankoides*, of the tribe *Ebertheae*, subtribe *Ebertho-anaerogeneae.* It may be of advantage perhaps to deal with these genera in a more detailed manner:

GENUS SHIGELLA CASTELLANI AND CHALMERS, 1918

Definition. — Ebertheae not fermenting lactose, glucose partially fermented with production of acid but no gas. Milk not clotted. Motility absent.

Type Species. — *S. dysenteriae* Shiga-Kruse 1899.

Classification. — Several species have been described but the two generally admitted as valid are the following:

1. *S. dysenteriae* Shiga-Kruse
2. *S. paradysenteriae* Collins

The two species are differentiated by their behavior in mannitol: *S. dysenteriae* does not produce acidity, *S. paradysenteriae* produces acidity. Of *S. paradysenteriae* Collins there are several varieties, Var. Flexneri, Var. Hissi-Russelli, Var. Strongi, Var. Duvali, etc. The two best known are:

S. paradysenteriae Collins Var. *Flexneri* (so-called Flexner bacillus)
S. paradysenteriae Collins Var. *Hissi-Russelli* (so-called Y bacillus)

These two varieties are differentiated by their reactions in maltose; the Flexner variety produces acidity in maltose, the Hiss-Russell variety does not produce acidity in maltose. I have found that they differ also with regard to their reactions on starches; the Var. Flexneri produces acidity in potato and ginger, the Var. Hissi-Russelli does not touch those two starches.

TABLE III

Differentiation between *B. dysenteriae Shiga-Kruse, B. paradysenteriae Collins Var. Flexneri, and B. paradysenteriae Collins Var. Hissi-Russelli* by Their Fermentative Action on Mannitol and Maltose

	Mannitol	Maltose	Remarks
Shiga-Kruse	O	AVS	Production of acid very slow
Flexner	A	A	
Y (Hiss-Russell)	A	O	

O = absence of acidity and of gas
A = acidity present
G = gas present
VS = Very slight

Differentiation of S. dysenteriae Shiga-Kruse, S. paradysenteriae Collins Var. Flexneri, and S. paradysenteriae Collins Var. Hissi-Russelli by Means of the Symbiotic Fermentation Phenomenon. — The symbiotic fermentation phenomenon has been described by me in previous publications. It may be defined as follows, "Two organisms neither of which alone produces gas in certain carbohydrates may do so when living in symbiosis or artificially mixed." For instance, *B. typhosus* alone does not produce gas in maltose (acid only), *B. morgani* does not produce gas in that sugar (neither acid nor gas); the mixture *B. typhosus* + *B. morgani* produces gas. The phenomenon, as I have shown in other publications, may be of assistance in the classification of certain bacteria. The more important dysentery bacilli of the genus *Shigella* may be differentiated as follows: The symbiosis *B. dysenteriae* Shiga-Kruse + *B. morgani* produces gas in maltose but not in mannitol; the symbiosis *B. paradysenteriae* Var. Flexneri + *B. morgani* produces gas in maltose and mannitol; the symbiosis *B. paradysenteriae* Var. Hiss-Russell + *B. morgani* produces gas in mannitol but not in maltose. The results of the symbiotic fermentation correspond to the results of the simple fermentation induced by the organisms themselves, viz., by symbiotic fermentation, gas is found in those carbohydrates in which the dysentery organisms alone produce simple acidity. The presence of gas, however, is much more striking than the presence of simple acidity; moreover, in certain cases—for instance, in the case of Shiga-Kruse with regard to maltose—gas becomes evident much more rapidly than acidity to litmus. With regard to the symbiotic fermentation phenomenon, the reader may find all the details in papers published by me in the "Journal of the American Medical Association," Feb. 20, 1926, Vol. LXXXVI, pp. 523–527, and in the Proceedings of the Society of Experimental Biology and Medicine, 1926, Vol. XXIII, pp. 481–488, and 1927 (February).

TABLE IV

Differentiation between *B. dysenteriae Shiga-Kruse, B. paradysenteriae Collins Var. Flexneri, and B. paradysenteriae Collins Var. Hissi-Russelli,* by Means of the Symbiotic Fermentation with *B. morgani*

	Mannitol	Maltose
Symbiosis Shiga-Kruse + Morgani	O	G
Symbiosis Flexner + Morgani	G	G
Symbiosis Hiss-Russell + Morgani	G	O

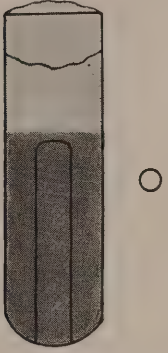
O = absence of acidity and of gas
A = acidity present
G = gas present

TABLE IVa

Differentiation between Shiga, Flexner and "Y" by Means of the Symbiotic Fermentation Phenomenon

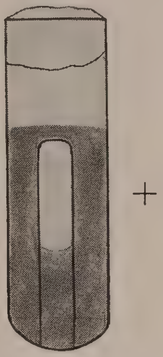
SHIGA

MANNITOL



SHIGA + MORGAN

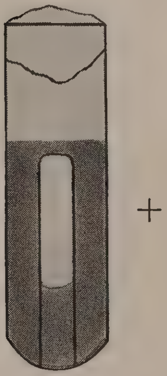
MALTOSE



SHIGA + MORGAN

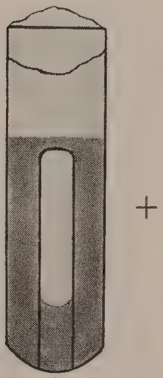
FLEXNER

MANNITOL



FLEXNER + MORGAN

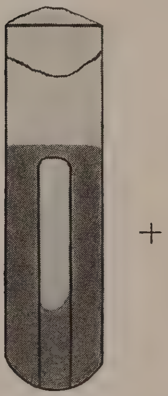
MALTOSE



FLEXNER + MORGAN

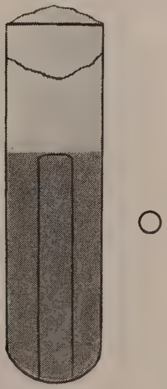
"Y"
(HISS-RUSSELL)

MANNITOL



"Y" + MORGAN

MALTOSE



"Y"+MORGAN

TABLE V

GENUS SHIGELLA

Castellani and Chalmers, 1918

(Reactions after an Incubation Period at 37° C. for 15 Days)

	Motility	Gram	Gelatine	Serum	Litmus Milk	Lactose	Glucose	Levulose	Maltose	Galactose	Mannitol	Dulcitol	Saccharose	Inulin	Isodulcitol	Inositol	Adonitol	Arabinose	Amygdalin	Salicin	Sorbitol	Raffinose	Dextrin	Erythrite	Glycerine	Ginger Starch	Potato Starch	Rice Starch	Indol	
S. dysenteriae Shiga-Kruse	0	0	0	0	0	0	A	A	0 or A	A	0	0	0	0	0	0	0	0 or A	0	0	0 or A	0	0	0	0 or A	0	0	0	0	Production of acid in maltose very slow
S. lunavensis Castellani 1912	0	0	0	0	As ALK	0	A	A	A	A	0	0	A	0	0	0	0	A	0	0	0	0	0 or A	0	0 or Avs	—			+	Differs from B. dysenteriae Shiga in fermenting saccharose and in producing indol.
S. negombensis Castellani 1910	0	0	0	0	0 or ALK	0	A	As	0	A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	—			0	Not agglutinated by Shiga-Kruse serum
S. paradysenterica Castellani 1904	0	0	0	0	A	0	0 or A	0	0	0 or As	0	0	0	—	0	0	0	0	0	0	—	0	0	0	0	—			+ —	Not agglutinated by Shiga-Kruse serum
S. paradysenteriae Collins Var. Flexneri .	0	0	0	0	0	0	A	A	A	A	A	0	0	0	0	0	0	A	0	0	0	0 or A	0 or A	0	0 or Avs	A	A	A	+	
S. paradysenteriae Collins Var. Hissi-Russelli.	0	0	0	0	0	0	A	A	0	A	A	0	0 or A	0	0	0	0	A	0	0	0	0 or A	0 or A	0	0	0	0	0	+ —	
S. paradysenteriae Collins Var. Strongi . .	0	0	0	0	A ALK	0	A	A	0	A	A	A	A	0	A	—	0	A	0	0	A	A	0	0	0				+	
S. tangellensis Castellani 1911	0	0	0	0	As ALK	0	A	A	A	A	A	A	A	0	A	0	0	A	0	A	A	0 or A	0 or A	0	A	—	—	—	+	
S. metafaecaloides Castellani	0	0	0	0	ALK	0	A	A	A	A	A	0	0	0	—	—	0	0	0	0	A	0 or A	A	0	—				0	

0 = No change, viz., absence of clotting in milk, absence of acidity and gas in sugar media
+ = Positive, viz., presence of clotting in milk, presence of acid and gas in sugar media, etc.
A = Acid
ALK = Alkaline

As = Acid, slightly
Avs = Acid, very slightly
AG = Acid and gas

GENUS LANKOIDES CASTELLANI AND CHALMERS, 1918

Definition. — The definition of this genus as given by Chalmers and myself ("Manual of Tropical Medicine," 3rd edition, p. 938) is as follows: "Ebertheae fermenting glucose partially, with the production of acid, but no gas; lactose not fermented or only partially, without gas production. Milk clotted." It is important to note that the fermentation of lactose and the clotting of milk is often very slow.

Type Species. — *Lankoides pyogenes* (Passet, 1902).

Classification. — The principal species recognized as valid by Chalmers and myself are the following:

L. pyogenes (Passet. 1902)
L. ceylonensis "A" (Castellani, 1907)
L. ceylonensis "B" (Castellani, 1907)
L. gintottensis (Castellani, 1910)
L. madampensis (Castellani, 1911)

Chalmers and I have given in our "Manual of Tropical Medicine" a key and a table for the recognition of these germs, based on certain biochemical reactions. This key and table, however, were based on the fermentation reactions shown by these germs after only a few days' incubation (3–6 days). I have found that if the organisms are incubated for a longer period, acidity appears in various sugars which at first are not touched; also certain strains, which, when recently isolated, apparently ferment only a very few sugars, later on after being subcultured several times, are capable of fermenting many more sugars. For instance, most strains of *B. ceylonensis* A and *B. gintottensis* will give acidity in very many more sugars than those mentioned in our key and table if incubated for over a week; moreover, some strains serologically true may produce acidity in numerous carbohydrates even after a short incubation. The best way of differentiating the various species is therefore by serological methods. The study of their fermentative reactions (both simple and by using symbiotic fermentative reactions) may, however, be helpful in some cases.

From a practical point of view the organisms of the Lankoides group may be separated into two principal types:—

L. ceylonensis "B" type—indol positive, production of acidity in lactose usually fairly rapid

L. ceylonensis "A" type—indol negative, production of acidity in lactose very slow, or absent. Clotting of milk may be extremely slow, taking 3 or 4 weeks.

Of each type there are several sub-types or varieties which are best differentiated serologically.

TABLE VI

GENUS LANKOIDES

Castellani and Chalmers

(Reactions after an Incubation Period at 37° C. for Three Weeks)

	Motility	Gram	Gelatine	Serum	Litmus Milk	Lactose	Glucose	Levulose	Maltose	Galactose	Mannitol	Dulcitol	Saccharose	Inulin	Isodulcitol	Inositol	Adonitol	Arabinose	Amygdalin	Salicin	Sorbitol	Raffinose	Dextrin	Erythrite	Glycerine	Starch (Potato)	Indol	Lead Agar	REMARKS
L. ceylonensis "B" Castellani 1907 (Strain RR)	O	O	O	O	AC	A	A	A	A	A	A	A	O or A	O	A	O	O	A	O	O	A	A	A	O	A	O or A	+	O	
L. ceylonensis "B" Castellani 1907 (Strain RW)	O	O	O	O	AC	As	A	A	A	A	A	A	O or A	O	A	O	O	A	O	O	A	A	O	O	A	O or A	+	O	The four strains of *B. ceylonensis B* are serologically identical; strains RR and O produce acidity in lactose rapidly, strain RW very slowly.
L. ceylonensis "B" Castellani 1907 (Strain LV)	O	O	O	O	AC	A	A	A	A	A	A	A	A	O	A	O	O	A	O	O	A	A	A	O	A	A	+	O	
L. ceylonensis "B" Castellani 1907 (Strain O)	O	O	O	O	AC	A	A	A	A	A	A	A	O or A	O	A	O	O	A	O	O	A	A	A	O	A	A	+	O	
L. ceylonensis "A" Castellani 1907 (Strain PD)	O	O	O	O	AC	O or AVS	A	A	A	A	A	O	A	O	A	O	O	A	O	O	O	A	AS	O	A	O	O	O	
L. ceylonensis "A" Castellani 1907 (Strain O)	O	O	O	O	AC	O	A	A	A	A	O or A	O	O or A	O	O or A	O	O	A	O	O	O	A	AVS	O	O or A	O	O	–	Some strains of *B. ceylonensis A* at first produce acid in glucose only; lactose is not fermented, or only very slowly; milk is clotted very slowly.
L. ceylonensis "A" Castellani 1907 (Strain Z)	O	O	O	O	AC	A	A	A	A	A	A	O	A	O	A	O	O	A	O	O	O	A	O	O	A	O	O	O	
L. madampensis Castellani 1911 (Strain H).	O	O	O	O	AC	A	A	A	A	A	A	O	AS	O	A	O	O	A	O	O	AVS	A	A	O	A	O	+	O	
L. pyogenes foetidus Passet 1902	+	O	O	O	AC	A	A	A	A	A	A	A	A	–	–	–	–	A	–	–	–	A	A	–	–	–	+	–	

O = Negative, viz., absence of clotting in milk, absence of acidity and gas in sugar media (medium may become alkaline)
+ = Positive, viz., presence of clotting in milk, presence of acidity and gas in sugar media, etc.
A = Acid
C = Milk clotted
AS = Acid, slightly
AVS = Acid, very slightly

Inoculation in the lower animals. — Serological reactions. — Peptone water and broth cultures of *Lankoides ceylonensis* "B," Strain RR, *Lankoides ceylonensis* "B," Strain RW, *Lankoides ceylonensis* "B," Strain O, inoculated subcutaneously (1 cc.–2 cc.) in rabbits, do not, as a rule, produce severe symptoms, although there are exceptions. Agglutinins are produced in a fair amount. The rabbits inoculated with any of the three strains of *L. ceylonensis* "B" will produce agglutinins for the homologous strain and for the other two strains of *L. ceylonensis* "B" in practically the same amount; as a rule, there is no agglutination for any strain of *L. ceylonensis* "A" or only slight; *L. ceylonensis* "A" serum does not agglutinate or only slightly strains of *L. ceylonensis* "B." *L. ceylonensis* "B" serum and *L. ceylonensis* "A" serum do not agglutinate *Lankoides madampensis.*

GENUS DYSENTEROIDES CASTELLANI AND CHALMERS, 1918

Definition. — Ebertheae fermenting lactose and glucose partially with the production of acid but no gas; milk not clotted.

Type Species. — *Dysenteroides metadysentericus* (Castellani, 1907). — The first strain of this organism was isolated in 1904, but was not named for some years.

Remarks. — This genus contains several organisms, one motile (*D. bentotensis*) and several non-motile: *D. metadysentericus* "A," *D. metadysentericus* "B," *D. metadysentericus* "C," *D. metadysentericus* "D," which Chalmers and I differentiated by their sugar reactions. These varieties, however, are better separated by serological methods, as the sugar reactions have a rather marked tendency to vary. It must also be noted that a number of strains which at first appear as belonging to this genus, belong, in reality, to the Genus *Lankoides;* these strains, if kept in the incubator at 37° C. for less than two weeks will not clot milk, but if they are kept under observation for more than two or three weeks their reactions are those of the genus *Lankoides*, milk becoming clotted.

Animal Experiments. — Toxic Action on Rabbits. — When broth or peptone water cultures are injected in ordinary doses (½ to 1 cc.) most strains are not toxic. Olivi, with a strain of *B. metadysentericus*, induced the death of a rabbit 5 days after a single injection of a 3 cc. dose, while rabbits inoculated with 2 or 1 cc. did not die. In the rabbits that died, the post-mortem showed inflammatory lesions similar to those found in rabbits inoculated with Shiga-Kruse.

REMARKS ON THE BACILLI OF THE GENUS LANKOIDES AND OF THE GENUS DYSENTEROIDES (METADYSENTERY BACILLI)

In practice it is useful to combine the two genera *Lankoides* and *Dysenteroides* into one group: the *Lankoides-Dysenteroides* group, or *Dysenteroides sensu lato*, or "metadysentery bacilli," because certain organisms which at first present the characters of the genus *Dysenteroides* after a prolonged incubation may show the characters of the genus *Lankoides*, viz., they will clot milk.

TABLE VII

GENUS DYSENTEROIDES

	Motility	Gram	Gelatine	Serum	Litmus Milk	Lactose	Glucose	Levulose	Maltose	Galactose	Mannitol	Dulcitol	Saccharose	Inulin	Isodulcitol	Inositol	Adonitol	Arabinose	Amygdalin	Salicin	Sorbitol	Raffinose	Dextrin	Erythrite	Glycerine	Potato Starch	Indol
D. metadysentericus Castellani Var. "A"	O	O	O	O	A	A	A	A	A	AS	A	O or AS	A	O	—	—	—	—	—	—	—	—	—	—	—	—	+ O
D. metadysentericus Castellani Var. "A" (Strain Z)	O	O	O	O	A	A	A	A	A	A	O or A	O	A	O	A	O	O	A	O	O	O	A	O	O	O	O	+ O
D. metadysentericus Castellani Var. "B" (Strain L)	O	O	O	O	A	A	A	A	A	A	O or AS	O or AS	O or AS	O	O or A	O	O	A	O	O	A	A	A	O	A	—	+
D. metadysentericus Castellani Var. "C"	O	O	O	O	A ALK D	AS	A	A	AS	A	O or AVS	O or AVS	O or AVS	—	—	—	—	—	—	—	—	—	—	—	—	—	O
D. metadysentericus Castellani Var. "D"	O	O	O	O	ALK	AS	A	A	A	A	A	A	A	—	—	—	—	—	—	—	—	—	—	—	—	—	+
D. bentotensis Castellani	+	O	O	O	A or A,ALK	A	A	A	A	A	O	O or AS	A	O	O	A	O	O	O	O or AS	O	O or AS	O	O	A	—	+

O = Negative, viz., absence of clotting in milk, absence of acidity and gas in sugar media (the medium may become alkaline)
+ = Positive, viz., presence of clotting in milk, presence of acid and gas in sugar media, etc.
A = Acid
AG = Acid and gas
ALK = Alkaline
— = Reaction unknown
AS = Acid, slightly
AVS = Acid, very slightly
D=Decolorized

The "metadysentery bacilli" (*Lankoides-Dysenteroides* group) are similar to the dysentery bacilli *sensu stricto* (genus *Shigella*, "dysentery-paradysentery" bacilli) in that they do not produce gas in any sugar; they differ from them, however, as they either produce acidity in lactose and clot milk, or produce acidity in lactose without clotting milk, or they clot milk without producing distinct acidity in lactose. Some of these bacilli have been known for years; *Bacillus ceylonensis* "A" and "B" were found by me in 1904 and 1905, their full description being published in 1907; and I isolated a strain as long ago as 1901, although it was not classified at the time—it is still in my collection. *B. gintottensis* I described in 1910; *B. madampensis* I isolated in 1910 and described in 1911; the first strain of *B. metadysentericus* was isolated in 1904, but was not named for some years. Chalmers and I created for these organisms two genera: *Lankoides* and *Dysenteroides*. Nabarro has given much attention to this group of organisms; he is inclined to identify them all with *B. coli anaerogenes* of Lembke, and in a very interesting publication in the "Journal of Pathology and Bacteriology," 1923, Vol. XXVI, pages 429–430, states the following:

> Lembke in 1896 isolated from the excreta of dogs a coliform bacillus producing acid but not gas in glucose and lactose media, to which he gave the name *B. coli anaerogenes*. Between 1905 and 1912 Castellani isolated several varieties in Ceylon which he has named *B. ceylonensis*, *B. madampensis*, *B. bentotensis*. These organisms all agree in the property of fermenting sugars, etc., with the formation of acid alone, the difference between them being of a minor nature.

Nabarro further states that he first isolated *B. coli anaerogenes* in 1912 from a case of dysentery at the Wakefield Asylum. In 1921 during an investigation upon summer diarrhoea and other diarrhoeal conditions in children, he isolated 30 strains of *B. coli anaerogenes* from 25 patients out of 107 investigated.

There is much to be said in favor of Nabarro's theory that the anaerogenes bacilli isolated by me and later by himself, Sonne and others are identical with *B. coli anaerogenes* of Lembke. As, however, since 1905, I have always found constant serological differences between the principal organisms of the group, I have retained in this paper in its general lines the classification introduced by Chalmers and myself.

Clinical Syndromes Associated with the Presence of Organisms of the Metadysentery Group (Lankoides-Dysenteroides). — These organisms have been isolated from clinically typical cases of dysentery; also from certain cases of obscure chronic colitis with no dysenteric symptoms; and also from certain cases in which fever was a prominent symptom, so prominent as to suggest the possibility of paratyphoid. The blood of the patients in whom *B. ceylonensis* "A," *B. ceylonensis* "B," and *B. metadysentericus* were isolated from the stool contained—in the subacute and chronic cases—a large amount of specific agglutinins for those organisms.

CONCLUSIONS

I. The dysentery bacilli may be conveniently grouped as follows:

(a) *Dysentery bacilli, sensu stricto*
(b) *Paradysentery bacilli*
(c) *Metadysentery bacilli*

The three groups have a very important characteristic in common: They produce no gas in any sugar. The first two groups are biochemically much more closely allied among each other than with the third group; the organisms of the first two groups never produce acidity in lactose and never clot milk; they differ, as well known, among themselves with regard to mannitol; those of the first group (Shiga-Kruse) do not produce acidity, those of the second (Flexner, Hiss-Russell) do. The organisms of the third group, on the other hand, either produce acidity in lactose and clot milk, or produce acidity in lactose without clotting milk, or clot milk without producing distinct acidity in lactose. The first two groups form the genus *Shigella;* the organisms of the third group form the genus *Lankoides* (milk clotted, lactose acid or no change) and the genus *Dysenteroides* (milk not clotted, lactose acid). The last two genera are very closely allied, and often organisms which at first are placed in the genus *Dysenteroides* have later to be placed in the genus *Lankoides,* as after a prolonged incubation they produce clotting of milk. It might therefore be advisable to combine the two genera into one genus. The principal pathogenic species of the third group seem to be *B. ceylonensis* "B," *B. ceylonensis* "A," and *B. metadysentericus.*

II. A somewhat similar nomenclature may be used to indicate the various types of bacterial dysentery:

(a) *Bacterial dysentery sensu stricto,* due to *B. dysenteriae* Shiga-Kruse

(b) *Paradysentery,* due to the different varieties of *B. paradysenteriae* Collins (Var. Flexneri, Var. Hissi-Russelli)

(c) *Metadysentery,* due to the metadysentery bacilli (bacilli of genera *Lankoides* and *Dysenteroides*)

III. Certain authorities believe that the metadysentery bacilli, viz., bacilli of the *Lankoides-Dysenteroides* group, may be identified with *B. coli anaerogenes,* a bacillus which Lembke isolated from the stool of a dog in 1896; and Nabarro, who has carried out a very important investigation on the subject, is inclined to favor the opinion that the organisms isolated by me and later on by himself, Sonne and others are in fact identical with that bacillus.

I am inclined not to agree with this opinion, as, since 1905, I have found constant differences between the principal species of the group, especially with regard to indol production and serological reactions. Some species of the metadysentery bacilli are pathogenic, others are not. Among the pathogenic ones are *B. ceylonensis* "A," *B. ceylonensis* "B," and *B. metadysentericus.* These bacilli, in addition to having been found in cases of typical dysentery, have been found also in obscure types of colitis in some cases of which fever was a prominent symptom.

LITERATURE

1907, Castellani, *Journ. of Hygiene*, Vol. VII, No. 1, Jan.

1911, Castellani, Reports of the Advisory Committee for the Tropical Diseases Research Fund

1912, Castellani, "Observations on Some Intestinal Bacteria Found in Man," *Capitralblatt f. Bakteriologie*, 65 Band, Heft 4/5

1916, Castellani, "Infezioni tifiche, paratifiche e miste della zona Adriatico-Balcanica," *Annali di Medicina Navale e Coloniale*, Fasc. V–VI, 1916

1918, Castellani, "Alcune oservazioni sulla etiologia, diagnosi e cura della dissenteria," *Annali di Medicina Navale e Coloniale*, Anno XXIV, Vol. I, Fasc. 1

1918–1919, Castellani, Reports of the Interallied Sanitary Commission, Office International d'Hygiene Publique

1919, Castellani and Chalmers, "Manual of Tropical Medicine," Chapters on Classification of Bacteria

1920, Castellani, "Classification de certains groupes de bacilles aerobies de l'intestin humain," *Annales de l'Institut Pasteur*

1923, Olivi, "The Virulence of Bacillus Metadysentericus Castellani in the Rabbit. Its Resistance to the Action of Sunlight." *Journ. Trop. Med. and Hyg.*, April 16

1926, Peruzzi, "Morphological and Cultural Investigation of *Vibriothrix zeylanica* Castellani," *Journ. Trop. Med. and Hyg.*, Feb. 1

1926, Bhattacharyya, "Brief Note on the Morphology, Cultural Characters—Biochemical Reactions of *Vibriothrix zeylanica* Castellani," *Journ. Trop. Med. and Hyg.*, Nov. 15

1926, White (P. Bruce), "Further Studies of the Salmonella Group," Medical Research Council, His Majesty's Stationery Office, Special Report Series, No. 103

LOBAR PNEUMONIA

H. M. WALKER, M.D.

Puerto Castilla Hospital, Puerto Castilla, Honduras

Lobar pneumonia is of special interest to us, inasmuch as this disease was responsible for 23 per cent of our hospital mortality for the year 1926. As will be noted in the comparative charts below, the mortality rate shows a considerable variation from year to year. During the year 1925, mercurochrome was given intravenously, in a 1% solution, to all fairly robust patients having lobar pneumonia, in doses computed at 23 cc. per 100 pounds of body weight. This line of treatment apparently resulted in a lower mortality rate than that of the two previous years (see Chart 2) when about the same number of cases came under treatment. During 1926 other methods were used, because of a change in the personnel of the medical service and a justifiable desire to investigate the treatment extolled by Nott:

CHART 1

Showing Treatment Data

		Deaths	Per Cent
*Total number of cases	63	23	36.50
Number treated with mercurochrome	31	12	38.70
Number treated with potassium permanganate	8	3	37.50
Number treated with digitalis and caffeine	21	8	38.09

*There were three cases not included in the above groups. Two were adults with a resolving pneumonia, and one a child; one of these cases required special attention.

CHART 2

Comparison with Previous Years

Year	No. Cases	No. Deaths	Per Cent
1921	31	8	25.80
1922	60	39	65.00
1923	97	52	53.61
1924	101	43	42.59
1925	100	30	30.00
1926	63	23	36.50

During the year 1926, 63 cases of lobar pneumonia were treated in the Puerto Castilla hospital, a decrease of 37 as compared with 1925. No reason other than a decrease in the number of employees in the division can account for this change. There was a total of 23 deaths, or 36.5 per cent mortality rate. Of the total number of cases treated, 31 received a 1% solution of mercurochrome as a part of the treatment. Each patient received only one dose, which varied between 15 and 20 cc., according to the approximate weight of the individual. This is a slightly smaller dose than was given during 1925. Nearly all cases treated received whiskey in ½-ounce doses every 4 hours during the course of the disease. In this group, there were 12 deaths, or 38.7 per cent. In three of these cases, however, the mercurochrome was given only shortly before death, and it undoubtedly had an untoward rather than a beneficial effect. The mortality rate was 27.3 per cent in lobar pneumonia treated with mercurochrome during the year 1925, and was therefore 11 per cent higher this year than last. Discounting the three cases in which the advisability of giving mercurochrome was questionable, we have a mortality for 1926 of 29 per cent, or 1.7 per cent higher than the previous year.

A number of patients were treated with caffeine citrate, digitalis, or a combination of these drugs. There were 21 cases in this group, with 8 deaths, or 38 per cent mortality.

During the last part of the year the treatment of pneumonia, as recommended by H. W. Nott, was used in all cases who entered the hospital. In brief, this treatment consists of rectal injections of a solution of potassium permanganate, 2 grains to 1½ pints of water. The amount recommended is from 3 ounces to ½ pint, according to the age of the patient and his ability to retain the solution. The injections are given every 3 hours, or at longer intervals if larger amounts are retained. The quantity is reduced as the patient improves. In addition, thyroid extract is given to certain cases. As to the value of thyroid substance, Nott[1] states as follows: "Too few cases as yet have been treated [to enable us] to say anything definite as regards the value of administering thyroid substance during the acute stages of the disease. Lately we have all come to look upon potassium permanganate as being specific in its effect, and most of us have not given thyroid, even during convalescence."

Nott gave ½ grain of the whole gland, twice daily for 2 weeks, to one of his cases, a youth 16½ years of age.

Apparently the physiological action of potassium permanganate in pneumonia is not known. This is also true of thyroid, and no mention is made of the symptoms which require or contraindicate its use.

The treatment nevertheless has given excellent results, according to Nott, who shows a mortality of only 5 per cent in 40 unselected cases, apparently mostly broncho-pneumonias. We have treated 8 cases with potassium permanganate, with a mortality of 37.5 per cent. This is higher than we expected but, with so few cases treated over so short a period of time, it would be impossible to criticize the method of treatment. None of our patients were given thyroid (nor were all of Nott's) and we had some difficulty in getting them to retain the solution of potassium permanganate in the larger amounts advised. Practically all cases received 3 ounces every 3 to 4 hours, day and night, until improvement or death. All were given digitalis or stimulation in some other form when indicated. A further study of potassium permanganate combined with thyroid in the treatment of pneumonia will be made next year, provided other investigations show better results than we have obtained by this method of treatment.

In none of our cases were there any untoward toxic effects from the use of the solution of potassium permanganate.

As in previous years, many of our pneumonia cases did not seek medical advice until their condition became alarming. In Chart 3, below, the influence of season, temperature, and rainfall is clearly shown to be negligible.

CHART 3

Showing Seasonal Incidence

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
Cases	5	6	8	4	7	4	6	6	4	5	3	5	63
Deaths	3	3	2	0	2	3	2	0	4	2	1	1	23
Average Rainfall	6.40	4.46	2.82	.59	2.64	4.47	3.35	6.86	5.06	12.22	27.2	11.15	87.22
Mean Temperature	77.5	77	78	82	81	82	81	81	81	80.5	77.5	78.5	80

To sum up—guided by our limited experience and by the results obtained with the mercurochrome treatment in lobar pneumonia, during the years 1925 and 1926, we believe that the favorable results warrant its use, provided it is given in proper doses and early in the course of the disease.

1. Nott, H. W., "The Thyroid and Manganese Treatment in Acute Pneumonia," *Brit. Med. Journ.*, No. 3,419, July 17, 1926, (p. 109)

AN UNUSUAL CASE OF CEREBROSPINAL MENINGITIS, DUE TO THE PNEUMOCOCCUS LANCEOLATUS, AND ITS RECOVERY

H. R. EICHELBAUM, M.D.

Pneumococcal meningitis is not of rare occurrence. Josephine Neal, in Tice's "Practice of Medicine," reports 67 cases of pneumococcal meningitis, all of which terminated fatally. Though the disease is practically always fatal, cases of recovery are on record. The above-mentioned author states that 24 known recoveries are reported in the literature (described by Lamar, Cummings, Parkinson, etc.).

As recovery from the purulent form of pneumococcal meningitis is so rare, and had never been observed in this division, a brief description and discussion of a case that recovered may be of some interest. This case also offered some rare features, and a somewhat new type of treatment was instituted.

The patient, A. C., age 24, colored, male, had been admitted to the hospital twice before, both times for haemorrhagic diathesis—i.e., after extraction of teeth outside of the hospital, he suffered from severe haemorrhages from the gums for 4 days. The bleeding was finally stopped by intravenous administration of 5 cc. of hemostatic serum and calcium lactate. During this time the urine showed a faint trace of albumin and a few pus cells.

On October 29, 1926, the patient was again brought in, this time on a stretcher. He was very sick, having suffered from fever and severe headache for two days.

Nutrition was below normal. Submaxillary, epitrochlear, and inguinal glands were slightly enlarged. Bones and joints appeared normal, and the muscles slightly rigid and painful. Mouth was dry, and the tongue furred. Most of the teeth had been extracted and replaced with an artificial set. Eyes and ears appeared normal, also the pharynx and larynx. Other than a few moist râles from a mild bronchitis, the lung findings were negative. Heart and blood vessels were absolutely normal; the blood pressure normal, 100 systolic and 80 diastolic. Abdomen was tender and retracted, and spleen enlarged and painful. Genitals showed no evidence of venereal diseases. Patellar and tendo-Achilles reflexes were exaggerated. Pupils were dilated, and the corneal and pupillar reflexes present. Pulse was 100, and temperature normal. Respirations, 20 per minute.

Urine was acid, the specific gravity 1,028, and showed a faint trace of albumin; pus cells and numerous cylinders were present in the sediment.

Blood was negative for malaria. Haemoglobin was 70 per cent.

Stool was negative for parasites.

The patient was purged with calomel (grs. 3) and mag. sulph. (1 oz.). Quinine and phenacetine were administered. The next day the patient felt worse, and suffered from a severe headache. A marked opisthotonos appeared. He complained of cramps and stiffness of the neck, head, and legs, and was unable to bend his neck. Herpes labialis appeared on both lips.

The Kernig's and Babinski's signs were positive. The temperature was still normal, but the pulse dropped to 76. A spinal puncture was performed, and from 40 to 50 cc. of purulent, yellowish, turbid spinal fluid under high pressure was withdrawn; and 30 cc. of antimeningococcic serum was immediately injected intraspinally.

Fehling's test on the spinal fluid was negative for glucose. The biuret reaction was positive, and a heavy coagulating albumin was present. Microscopically, the spinal fluid showed innumerable polynuclear leucocytes and a few lymphocytes. The smear showed Gram-positive, lanceolate, encapsulated diplococci, and the culture showed encapsulated Gram-positive pneumococci and staphylococci. Both the blood serum and the spinal fluid were negative (Kahn and Meinecke tests).

On the 3rd day after admission the patient developed fever and more rigidity; 50 cc. more of spinal fluid were withdrawn, and the spinal canal was irrigated with from 80 to 90 cc. of physiological salt solution, and 20 cc. of antipneumococcic serum were subsequently injected intraspinally.

On the 4th day the fever rose to 102° F., but the pulse remained at 78. Withdrawal of fluid and irrigation of the spinal canal were repeated, and 20 cc. more of antipneumococcic serum were injected intravenously.

The 5th day passed without any rise of fever. Constipation was pronounced. The same intraspinal therapeutic procedures were repeated.

On the 6th day the temperature rose, and still constipation was obstinate. The same intraspinal therapeutic measures were again repeated.

On the 7th day fever and constipation were still present, and the left epididymis became unexplainably inflamed. The same therapeutic procedures were once more repeated on this, as well as on the 8th day.

On the 9th day only the antipneumococcic serum was administered intraspinally. After this, no more intraspinal treatment was given. The fever still continued for a few more days; after that, the patient had a slow but undisturbed convalescence and received, in addition to tonics, sodium bromide, and some anti-gonococcic vaccine because of the epididymitis.

The spinal fluid was examined daily. After the 5th day it began to clear up, and in the smear therefrom only a few leucocytes were found. The pneumococci had entirely disappeared and no more growths could be obtained from cultures.

After the 10th day the fluid was still turbid, but white; Fehling's-Pavy negative, biuret positive. Many cells were present, but no bacteria.

After the 18th day the spinal fluid had entirely cleared up. The Pavy solution was reduced by glucose. The smear of the centrifugate showed only a few lymphocytes. The urine was normal, except for a few casts.

Looking for a possible focal infection, we examined:

Nose:	Septum deviated to the left.
Eyes:	Pupils reacted to light and convergence. Retinoscopy normal.
Ears:	Meatus O.K. Right drum smooth, shining, reflex of ossicle present; left tympanum did not show any perforation, was not so transparent as the right, but cloudier and dimmer, reflex present—drum thickened.
Larynx:	Vocal cords white and normal.
Teeth:	Mostly missing; patient uses artificial ones.
Genitals:	Left-sided epididymitis, but no gonorrhoea, nor was there any history of same.

After 32 days' stay in the hospital, the patient was discharged in a good, healthy condition, although he still complained of pain in the region of the spleen. All reflexes acted perfectly. Kernig's sign was negative and the spinal fluid was normal. An anaesthetic zone of palmar size was present on the outside of the left femur. The left epididymis was slightly enlarged.

A month after his discharge the patient returned again to the hospital for examination and his condition was found to be unchanged.

DISCUSSION

From the differential diagnosis standpoint, no other form of purulent meningitis is possible. Moreover, the Gram-positive pneumococcus lanceolatus was encountered in the smear and in the culture. No other Gram-negative diplococcus was present. The serum and the spinal fluid were negative for lues.

Another puzzling question is to locate clinically the primary focus. But here we are at a loss, if we do not accept the minor findings in the left ear or the bronchitis at the onset. The haemorrhagic diathesis of the anamnesis indicates some haemolytic process in the body, and makes the existence of a primary focus possible. But the primary focus has not been definitely proved; therefore we have a pneumococcal meningitis of kryptogenetic origin.

The course of this disease was unusual, as indicated by the irregular temperature, the absence of fever in the first three days, the absence of haemorrhagic skin eruptions, the complicating epididymitis, and the prolonged absence of glucose in the spinal fluid, which, according to Tice, is an unfavorable sign.

The treatment consisted mainly of spinal puncture and lavage and intraspinal injections of anti-pneumococcus serum (Parke, Davis & Co.). We are of the opinion that this procedure was responsible for the favorable outcome.

INFLUENZA IN THE TROPICS, WITH SOME CASE REPORTS

O. T. BROSIUS, M.D., D.T.M. and H.
Almirante Hospital, Panama

During the influenza epidemic in Almirante, Panama, early in 1926, some interesting cases, as well as certain special features of possible epidemiological interest, came to the attention of our staff. A few introductory remarks, regarding aetiology, symptoms, variations, complications, and diagnosis of the infection in connection therewith, will be given as helpful to the later discussion.

In presenting so complex a subject, concerning which so much has been said and written, I do not intend any ponderous résumé, but I will include any divergence from the regular course which influenza might be particularly prone to follow in tropical zones, and any complications which may in any way need to be differentiated from those of strictly tropical diseases.

As we consider this infection to be a true pandemic, we may not speak of epidemics in connection with it, but must refer to rises and lulls in the pandemic as recrudescences or exacerbations, with their subsequent remissions.

Certainly for more than sixteen centuries, i.e., since the great black plague decimated so large a part of the globe's population, influenza has been—and it still is—the world's most outstandingly important pandemic, and its terrific visitation in 1918 and 1919 was the most dreadful scourge that the modern world has ever known. Its terrific toll in the United States, alone, was over 250,000, or five times the number of American soldiers who were killed in the World War. Up to the time of the pandemic, the important clinical features of influenza had been quite clearly understood: the peculiarity of its sudden onset, which gave it the name "la grippe"; its course; its division, by Osler, into the three types—respiratory, intestinal, and nervous; its complications; and the various—"almost specific"—treatments recommended by different authorities. But the new and distinct variety puzzled the entire medical profession. All symptoms and signs were tremendously exaggerated, and those physicians in the Tropics who had had previous experience with pneumonic plague immediately felt alarm when suddenly called upon to deal with cases of this new infection, particularly those with pulmonary complications. They appreciated, in the physical signs of pneumonic plague, the strong similarity to the complicating broncho-pneumonia in Spanish influenza. The following symptoms of the haemorrhagic pneumonitis of influenza are strikingly similar to those of the "plague pneumonia": peculiarly sudden onset; cough; entire disproportion between the severity of symptoms and pulmonary findings; blood-tinged, watery expectoration; septicaemic type of temperature; lack of response to treatment; the cyanosis which accompanies both diseases in their later stages, and which gave pneumonic plague its sinister synonym of "the black death"; and sudden death.

In this new variation of the disease the bacteriologists were more puzzled than the clinicians. For those who termed it "Spanish influenza," the aetiological factor—the bacillus influenza of Pfeiffer—was disappointingly absent in some of the severest cases, and the bacteriologists found that in these victims certain strains of haemolytic streptococci were not infrequently prevalent. No single organism could be incriminated as the true aetiological factor; there seemed to be mixed infections; Koch's law did not apply; and there were no specifics in the treatments. The knowledge as to just what association this new modification of the disease bore, and still bears, to true influenza is therefore still vague.

Somewhere in the literature of medical history, the introduction of syphilis into Europe is described thus: A soldier returning from the Holy Land during one of the crusades arrived at his native village, in France, suffering from an acutely high fever and, just as he cried out his words of greeting, he fell dead. Because of the great pustules covering his entire body, the disease was called the "great pox," in contradistinction to smallpox, which it resembled; the symptoms of the former condition were at that time more intense. The "great pox" was also extremely infectious. It spread over Europe like a plague and, remaining endemic there, it gradually began to run a more extended and protracted course until, now —with a certain amount of acquired immunity in the civilized races—it has assumed its long-drawn-out, four-stage, insidious course.

And so, too, with the so-called Spanish influenza. In its first acute, death-dealing attack of 1918 and 1919, it was most violent, but became more insidious and protracted with every subsequent return, each of which bore resemblances more closely to, and merged with, the type with which we were acquainted in the "ante bellum" days. For statistical purposes in epidemiology, there is the frequent tendency (erroneous of course) even among well-trained medical men, to diagnose simple cases of coryza, pharyngitis, laryngitis, and bronchitis as "mild influenza," and in the Tropics dengue and six-day fever are often confused therewith. But disregarding these common and very frequently pardonable mistakes, we cannot doubt that each consecutive recrudescence of the disease since 1918 has been successively milder.

History apparently indicates that the severe type of the disease, such as the Spanish influenza, seems to appear approximately every two or three decades, i.e., with each generation, followed by recrudescences, each one of which shows successively decreased virulence. This may be explained by a relative immunity-producing factor occurring with each generation. But it is strikingly characteristic that only the severe recrudescences are followed by the serious complication, encephalitis, which, especially in some tropical countries, is apt to cause alarm at first because of its resemblance in its symptomatology to the "sleeping sickness" of Africa. The diagnosis, however, differs as follows:

The symptoms and signs with which the "sleeping sickness" of trypanosomiasis is ushered in (such as terrific headaches, photophobia, dizziness, fever, swelling of cervical glands, muscular cramps, tremors, swollen ankles, enlarged spleen, Kerandel's sign, and the characteristic rash) may be immediately disregarded, and only the distinctive features of the later stages of this disease need be considered:

1. Although the view is disputed by certain authorities, I believe it is generally accepted that cases of *Encephalitis lethargica* occur only in the wake of severe so-called influenza epidemics. The reason for this difference of opinion is that a few cases of encephalitis were, unexplainably, first seen in Vienna before that city was attacked by the influenza in 1918.

2. Sleeping sickness due to trypanosomiasis, of course, has been found only in certain localized parts of Africa.

3. The trypanosomes can usually be found in the blood or spinal fluid, or by gland puncture, although sometimes the search for them must be persistent.

4. The onset of epidemic encephalitis usually follows prolonged catarrh of the upper respiratory tract, and is sudden, beginning with somnolence (lethargy) and fever and succeeded by the characteristic paresis, but not accompanied by the striking terrific frontal headache and photophobia that usher in the "sleeping sickness" of Africa.

5. The tremors existing in both diseases are more apt, in *Encephalitis lethargica*, to be of the nature of intention tremors.

6. In *Encephalitis lethargica* the optic and motor oculi nerves are always affected, producing constantly blurred vision, diplopia, vertigo, and so on.

7. The lethargy in the encephalitis of influenza is continuous and the mental derangement always greater than in trypanosome "sleeping sickness," in which the listlessness alternates with stages of excitement, and the patient is often mentally alert.

In the main, because of the strictly geographical location of the trypanosome infection, there is little danger of confusing the two maladies. When, however, sporadic cases of the infectious encephalitis begin to appear in given communities —especially if these are tropical or semi-tropical—immediately the fearful question always arises whether, with the ever-increasing commercial intercontinental intercourse and traffic, sleeping sickness may not have been transported from its fertile African field to the locality in question. Then the physicians and sanitarians are called upon for a hasty, accurate, differential diagnosis.

Altitude, temperature, and humidity may all have some undetermined bearing on the severity of the symptoms of influenzal infection from an epidemiological standpoint. I believe it is safe to say that for some apparently unknown reason simple, uncomplicated influenza is not generally as serious in the Tropics as in the more temperate climates; consequently, it is not generally accompanied by such a high degree of mortality. It is not so acute, but runs a longer and more insidious course. This is also the case with the minor ailments of the respiratory tract, — such as coryza, pharyngitis, laryngitis, and bronchitis; and apparently this rule also holds good, to a certain extent, for all the complicating forms of pneumonia. They usually run longer courses, and even the lobar pneumonias have a strong tendency to terminate by lysis. This tendency, however, does not decrease the mortality rate in the pneumonias, because the longer courses of illness tend to weaken the myocardium, lower the general resistance, and induce serious secondary complications. In my experience this observation applies to all types of pneumonia occurring in the low lands of tropical America, including those complicating influenza. An illustration of one of these insidious wandering types of the infection is represented by the following report of a case of haemorrhagic pneumonitis.

Case No. 1.—Mr. V., Italian, born in Costa Rica.

Past illness. — He had suffered repeated attacks of malaria, and, as an officer in the Italian Army during the World War, had been seriously injured, having been wounded several times by rifle bullets and shrapnel. From these wounds, however, he had made complete recoveries. He was admitted to the hospital for an operation for inguinal hernia, which was performed under novocaine. On the 6th day after the operation his temperature, which had been normal, suddenly shot up to 102.6° F., accompanied by a chill, and a pulse rate of 104.

A physical examination at this time showed a very well-developed and fairly well-nourished man, 38 years old. The only positive finding was an enlarged, hard spleen. The urine showed a faint trace of albumin and a few pus cells in the sediment. Stools were negative. The blood smear showed tertian malaria. Haemoglobin was 75%.

He was immediately given quinine grs. 15 t.i.d. The fever subsided, and he was discharged from the hospital 10 days afterward. Five days later he was brought back to the hospital on a stretcher, with an entirely new train of symptoms. He had been taken suddenly ill with excruciating pains in the right side of the chest, accompanied by fever, cough, and profuse blood-streaked expectoration. The temperature on admission was 100° F. but rose to 101° F. soon after. He had a pulse rate of 112 and respirations 30 per minute. The lung findings were the following:

Loud pleural friction rubs were heard on the right side, extending from the axillary space to the 7th rib. Showers of fine, moist, and a few dry rales were heard at the base of the right lung. Definite small areas of consolidation were noted—more appreciably by vocal fremitus than by percussion—in the central portions of the lower and middle lobes of the right lung, but not as far down as the base. An X-ray picture also showed a definite shadow in this region.

The sputum, thick and sticky at first, became gradually more liquid and less blood-stained, and the lung signs began to clear up as the fever subsided, so that on the 10th day the patient had apparently almost completely recovered.

Seven successive sputum examinations were made; all of them were negative for acid-fast bacilli, but showed that the predominating organism was a short, stubby bacillus with rounded ends, Gram-negative, and with a tendency to bipolar staining. It was morphologically and characteristically identical with Pfeiffer's *B. influenzae*. Aside from the bacilli of this type, large Gram-positive, lanceolate, and encapsulated diplococci (*pneumococci*) were occasionally found, as well as a short chain streptococcus.

On the 12th day after admission, the patient was again suddenly seized with severe pleural pains on the left side; the temperature rose to 101° F. The pulse rate was 112, and respirations were 24 to the minute. Symptoms indicated a complete relapse. The same laboratory findings and, on careful examination, the same physical signs and X-ray findings were disclosed in the left chest as had been found in the right. Again the pulmonary symptoms (the expectoration of bloody sputum, the cough, the pain) and the temperature gradually subsided until, by the 25th day of his stay in the hospital, all symptoms and signs had entirely disappeared. He was discharged, well, on the 27th day after admission.

In the Almirante hospital, during the year 1926, there were 2,802 hospital admissions, of which 44 were diagnosed influenza. The majority of these occurred during January, February, and March. Of these, 5 developed pneumonia. It is interesting to note that during this so-called "epidemic," 3 cases that were admitted to the hospital with malaria developed influenzal pneumonia in the ward more than one week after admission. The entire hospital is open on all sides and exceedingly well ventilated, but when these cases occurred the ward was immediately evacuated and thoroughly fumigated, after which no more cases developed in the hospital.

An incident indicating a house infection was that of our hospital clerk. His entire family became ill, one by one, with severe influenza and each, on recovery, suffered a second attack. Two of the children were admitted to the hospital with influenzal broncho-pneumonia. The family was then removed to other quarters and the house was fumigated, after which no member of the family suffered again from the disease. The two children recovered; one of them had symptoms which indicated an intestinal complication. As some authorities are skeptical regarding the existence of intestinal influenza as an entity, the following report of this case is submitted:

Case No. 2. — D. P., female, age 4 years. Her past history showed that she had had varicella and one attack of malaria, but was otherwise negative until recently, when she had had an attack of influenza for which she was treated in the out-patient clinic. Following temporary improvement, she suffered a relapse, and after a week's serious illness was admitted to the hospital on January 1, 1926, with broncho-pneumonia, apparently a complication of the influenzal attack.

The typical lung findings were present: — Fever, rapid pulse, moist and dry pulmonary râles—fine, medium, and coarse—and the usual small areas of consolidation scattered over both lungs. There were a blood-tinged expectoration after violent attacks of cough; severe headache; and pains over the entire body, more especially in the back. The physical examination was otherwise negative.

Laboratory findings were as follows:

1. The Pfeiffer's bacillus was isolated.
2. The urine examination showed:
   Reaction, acid; albumin, faint trace; otherwise negative.
3. Stools negative.
4. White count—10,000
5. Haemoglobin—75
6. Differential white count:

	Per Cent
Polymorpho-neutrophiles	66
Transitionals	2
Large mononuclears	5
Lymphocytes	27

The temperature on admission was 102° F., and continued approximately between it and 103° F. for 4 days, i.e., until January 5th, when it suddenly fell to normal but immediately rose to 101° F. again. From then on it subsided by lysis and became normal on January 16th. At this date all lung symptoms had entirely disappeared. On January 19th the temperature rose again to 100° F., and on the 20th to 103° F. A pneumonia relapse was suspected, but the lungs were found to be absolutely negative.

A new group of symptoms had appeared. Before the sudden rise in the temperature there was a persistent constipation which, after being relieved, was followed by fever, restlessness, nausea, vomiting, and pains over entire body, but more pronounced over the abdomen, which was also tender on pressure. The constipation was obstinate and necessitated treatment. With enemata a greenish mucus was frequently expelled. The abdomen became very much distended, but there was no rigidity, and as the nausea, vomiting, and abdominal pain continued, peritonitis and obstruction were considered as possible underlying causes.

The laboratory examinations at the time showed the following:

1. Widal test—negative
2. Urine examination showed only a faint trace of albumin, and the sediment a few red blood corpuscles and pus cells.
3. White blood count—8,800

4. Differential white count:

	Per Cent
Polymorphonuclear neutrophiles	54
Transitionals	4
Large mononuclears	6
Lymphocytes	36

The temperature continued between 103° F. and 105° F. for more than 10 days and finally, on January 31st, began to subside slowly by lysis, not reaching and remaining normal until February 7th.

The patient was discharged on February 19th. Cathartics, enemata, and laxatives had to be given daily almost up to the date of her discharge.

We have had similar cases in other children. It seems quite reasonable to suppose that the expectoration swallowed by children suffering from influenzal broncho-pneumonia may often carry the infection to the intestinal tract, if the organism is successful in escaping destruction by the gastric juice. It seems rather doubtful that there should be any metastatic factor.

These cases seem to be very much more common than reports indicate. The diagnostic features that differentiate intestinal influenza from typhoid are:

1. The isolation of Pfeiffer's bacillus
2. Negative Widal in influenza
3. A greater tendency toward constipation in influenza than in typhoid
4. The pulse is usually not as slow in influenza as in typhoid.
5. The leucopaenia is more marked in typhoid than in influenza.
6. The usual, but not constant, absence of rose spots in influenza
7. A respiratory form of influenza more often precedes the attack, although typhoid fever is often ushered in with an acute bronchitis. However, intestinal influenza has been known to precede the respiratory form (Leichtenstern).
8. A more abrupt onset in influenza than in typhoid
9. The entire course of the intestinal influenza is usually shorter than that of typhoid.
10. The generalized body pains and aches and the abdominal tenderness are more marked in influenza than in typhoid.
11. Positive blood cultures are easily obtained early in typhoid.
12. There is usually more enlargement of the spleen in typhoid than in influenza.
13. Typhoid is accompanied by a greater degree of stupor than influenza.

The other diseases which are peculiar to tropical and sub-tropical regions, and with which influenza has been confused, are dengue and "six-day fever." The latter, which resembles dengue very closely, was first described by Deeks, in Ancon Hospital, in 1912. In these two diseases the respiratory symptoms and signs that play so prominent a part in the diagnosis of influenza are absent, and it is only in the nervous phenomena that the similarity is striking. In the severer forms, or the types of influenza in which certain nervous syndromes are accentuated and the respiratory signs are only vaguely manifest, i.e., the so-called "nervous influenza," the differentiation from dengue or "six-day fever" may not be apparent until the appearance of the rash in the two last-named disorders. Rarely, however, are the myalgias, arthritic pains, backaches, and headaches of influenza as severe as in dengue or "six-day fever."

Encephalitis has been discussed. Psychoses have been reported as sequelae to influenza. Neurasthenia, a very common tropical ailment, may be initiated by influenza, according to Osler.

Meningitis is such an extremely uncommon complication of influenza that only the essentials of the following case report are presented as of interest:

> *Case No. 3.* — A boy, 2½ years old, was admitted to the hospital, with a history of having had a severe cold with cough and fever for 2 weeks, and a convulsion the night before admission.
>
> He was admitted in a semi-conscious state, suffering from occasional convulsions, which were aggravated when he was handled.
>
> The typical meningeal symptoms and signs were present. Temperature was 101° F. on admission and the pulse rate 104. The spinal fluid was yellowish brown in color, and under increased pressure. A centrifuged stained specimen showed the presence of many short, thick bacilli with rounded ends, Gram-negative, and identical morphologically with the *Bacillus influenzae* of Pfeiffer.
>
> The day after admission, the temperature rose to 102.5° F. and on the succeeding morning to 105°; death followed shortly after.

In our experience, otitis media and kidney complications, especially pyelitis, occur frequently, while heart involvement is comparatively rare. In the severest form in which cyanosis is seen, the myocardium shows signs of toxic involvement or degeneration. Jaundice was not present in any of our cases.

In conclusion, I may state that in the Tropics the dread of an influenza epidemic gives less concern than it does in the temperate climes, not only because it seems to run a milder course in these regions, but mainly because of the excellent ventilation everywhere—in houses, hotels, hospitals, and public buildings—which seems materially to prevent the rapid spread of the infection. If this premise is true, it probably explains also why the lower-class tropical natives suffer more during influenza epidemics than do the foreigners; believing, as they do, that the night air causes disease, they close, and even seal, all doors, windows, and other apertures at night, thus contributing materially to the spread of infectious diseases such as influenza.

TOXIC CIRRHOSIS AND PRIMARY LIVER CELL CARCINOMA COMPLICATED BY HISTOPLASMOSIS OF THE LUNG*

B. M. PHELPS, M.D., AND F. B. MALLORY, M.D.

The case reported here illustrates exceedingly well the value of making routine post-mortem examinations whenever possible. Two of the lesions to be described were entirely unsuspected, clinically. Both are rare, especially the histoplasmosis which represents, so far as we know, the fifth case on record.

---

*From the Medical Service of the Truxillo Railroad Company Hospital, Honduras, and the Pathological Laboratory, Boston City Hospital, Boston, Mass.

CLINICAL HISTORY

Case Report. — R. O., Honduranean, male, age 24 years. Employed as a banana farm laborer, he was admitted to the Truxillo Railroad Company Hospital at Puerto Castilla, Honduras, on January 29, 1926, complaining of having had fever for the three nights previous, and pain in the liver and the spleen at intervals for a month past. He had taken 10 grains of quinine daily for some time previous to admission.

Physical examination shows a poorly nourished young native, with a rather prominent abdomen. Tongue is heavily coated. Liver is enlarged, and is palpable 4 fingers below the costal margin. The enlarged spleen extends below the umbilicus. There is a friction rub over the base of the right lung. Examination of the blood is negative for malaria, in both thick and thin films; haemoglobin 60 per cent (Tallquist). The flocculation test for syphilis (Meinicke) is positive. Urine negative; stools positive for ova of ascaris, otherwise negative. Temperature and pulse normal.

The patient was given potassium iodid grs. xv t.i.d., and for a few days was placed on quinine sulphate grs. xx b.i.d. On the 5th day he was given chenopodium treatment, and on the 6th day, 0.45 gm. of neosalvarsan intravenously. The latter drug was repeated 6 days later with a 0.9 gm. dose. The bowels were loose from the date of admission, the patient having from 2 to 11 stools of watery character during each 24 hours. Repeated stool examinations, after oil of chenopodium treatment, were negative except for mucus. From date of admission (January 29th) to February 10th, the patient's pulse and temperature remained normal; then temperature rose to 101° F. The gums were sore and there was evidence of salivation. The iodides were discontinued and mouth washes given. On February 11th there was a severe epistaxis, and signs of circulatory failure were observed, with oedema of the legs and ascites. He was then given calcium lactate, digitalis, and strychnine. There was excessive vomiting, which was relieved to a great extent by stomach lavage.

On February 14th the urine showed a trace of albumin; stools were negative. The leucocyte count was 7,860, with 78 per cent polynuclear neutrophiles, 20 per cent small lymphocytes, 1 per cent large mononuclears, and 1 per cent eosinophiles. The temperature varied from normal to 101° F. during the following 3 weeks, with vomiting at intervals, and a gradual increase in the amount of fluid in the abdomen. On March 16th paracentesis abdominalis was performed and 5 liters of blood-stained fluid were removed. On March 24th, 8 liters more were removed. The patient continued to lose strength, and death ensued on April 4, 1926, the temperature having been normal or below normal during the final week.

Clinical diagnoses. — (1) Cirrhosis of liver, (2) Malarial splenomegaly, (3) Tertiary syphilis.

Post-mortem examination (by Dr. Walter Jantzen, Puerta Castilla). — The body is poorly nourished and the abdomen distended. There is a scar of an old wound in the midline from 4th interspace to the umbilicus. On both sides, the diaphragm is at about the height of the 3rd interspace. The left lung is normal, the right lung shows scattered, pea-sized, hard masses, which on section are found to be dark red. The heart is enlarged, and some gelatinous matter is found in the pericardial sac, at the apex and near the base. The muscle is soft and of a grayish color; the endocardium, pericardium, and aorta are normal. The abdomen contains about 5 liters of bloody fluid. The pancreas, kidneys, intestines, and urogenital system are apparently normal. The spleen is greatly enlarged, and on section shows an increase in interstitial tissue; the liver is very large (10 lbs.), with an irregular surface. The left lobe is dark red, the lobules are prominent, and grayish nodules of different sizes are scattered throughout the tissue; the right lobe is a hard, grayish mass dotted with many yellow spots.

Post-mortem diagnoses. — (1) Cirrhosis of liver, (2) Gummata.

Microscopic examination:

Heart. — Muscle fibers small; marked atrophy of fat cells in the subepicardial tissue; moderate thickening of intima of arteries.

Lungs. — The lesions mentioned on gross examination show increase of connective tissue, with infiltration by numerous plasma cells, moderate compression of some of the air sacs—so that the lining epithelial cells in many of them are cuboidal in shape—and dilatation of others. In the air sacs (Fig. 1, page 121) and in some of the bronchioles is an exudate consisting of endothelial leucocytes. Some of the leucocytes contain carbon, others are distended with small parasites, and still others have both carbon and organisms scattered in the cytoplasm. Some of the leucocytes contain one or two dozen or more of these bodies, which lie within very distinct vacuoles. In time the organisms die off, leaving a large cell (which may be multinucleated) with vacuolated cytoplasm (Fig. 2, page 121). Cells of this type are most numerous in the centers of the lesions, while living parasites are most abundant at the periphery. Some of the phagocytic cells are multinucleated (Fig. 3, page 122), containing eight to ten or more nuclei located centrally, never murally as in the giant cells of tuberculosis. A few of the parasites seem to lie free in the air sacs. None can be found in the endothelial cells lining blood or lymph vessels.

Sections of the lung were submitted to Dr. E. E. Tyzzer, Professor of Comparative Pathology, Harvard Medical School, who confirmed the diagnosis of histoplasmosis of the lung, but who wanted more evidence before accepting them as protozoan in character.

Spleen. — Marked fibrous thickening of capsule. Blood sinuses distinct, and their walls thickened. No parasites can be found.

Liver. — The more normal part is cut into islands of different sizes by narrow strands of fibrous tissue. The appearance suggests moderate sclerosis following healing of acute necrosis of liver cells (acute yellow atrophy type of cirrhosis). The main lesion is a new growth composed of epithelial cells which, in places where they are well differentiated, resemble liver cells. A few of them are multinucleated as the result of multiple mitosis. In places, the tumor is growing within blood vessels.

Kidney. — Moderate oedema of tubules, numerous hyaline casts, slight infiltration of stroma by lymphocytes.

On careful examination, no parasites similar to those in the lungs could be found in any of the other organs.

Microscopic diagnoses. — Toxic cirrhosis of liver. Primary liver cell carcinoma. Broncho-pneumonia, due to *Histoplasma capsulatum*. Chronic splenitis with hypertrophy due to obstruction of portal circulation.

Toxic cirrhosis is one of the five more common types of cirrhosis. It occurs not infrequently, but is perhaps the variety least generally understood and recognized by both the clinician and the pathologist. It follows recovery from acute yellow atrophy of the liver, a lesion which may be due to the action of a variety of toxic agents, such as chloroform, carbon tetrachloride, arsenic, and streptococcus toxin. The primary lesion is necrosis of the liver cells in the centers of the lobules. The necrotic cells can be replaced by regeneration in the course of from one to two weeks. If, however, the lesion is so severe that all the liver cells in some of the lobules are destroyed, regeneration occurs only in those lobules in which liver cells survive. In other lobules, although the bile duct epithelium proliferates, it can not produce liver cells. As a consequence these lobules shrink, the stroma condenses, and the liver appears depressed and sclerotic between elevated islands of regeneration. Occasionally, in some parts of the liver, regeneration may be in excess of normal. As a result large nodules of liver cells may be found with no bile ducts in them. Sometimes they are so large as to be called adenomas, and they may be single or multiple. Occasionally the cells in one of these regenerating nodules get beyond control, as in this instance, and grow as a primary liver cell carcinoma invading and destroying the liver itself, growing into blood vessels, and giving rise to metastases in the lungs and elsewhere. Toxic cirrhosis apparently ranks next to pigment cirrhosis in causing primary liver cell carcinoma.

Histoplasmosis. — The disease and the causative agent (*Histoplasma capsulatum*) were discovered by Darling in 1905–6 while he was searching for the parasites of Kala-azar by examining smears from the spleen, liver, and rib marrow of all cadavers in which there was splenomegaly. Two negro laborers from Martinique and a Chinese furnished the material for his study. Recently a 4th case, a woman born in Germany, who had lived in Minnesota for 42 years and had never been in the Tropics, was reported by Watson and Riley.

The microorganism causing the disease is oval to round in shape, measures 1 to 4 microns in diameter, and is distinctly larger than the Leishman-Donovan bodies (Fig. 4, page 122) of tropical ulcer, but considerably smaller than the parasites in blastomycosis (Fig. 5, page 123). Its morphology is exceedingly difficult to make out, at least in sections. It contains an irregular, often crescent-shaped, nucleus which stains readily but not evenly. No chromatin rod is present as in the Leishman-Donovan bodies of Kala-azar. The cytoplasm is vacuolated and takes a slight basophilic coloring.

Darling states that a capsule can be seen around the organisms in the smear preparations, and on this account he added the descriptive word *capsulatum* to the name. No capsule could be demonstrated in sections stained with the eosin-methylene blue or the Giemsa method.

On applying the Gram-Weigert stain to sections, it was found that all the young, active forms were colored intensely blue-black and stood out even more sharply than staphylococci do under the same conditions, because larger. The same method applied to sections from two different cases of blastomycosis gave entirely negative results; the blastomycetes are not Gram-positive, at least not in sections. On the other hand, in paraffin sections of Zenker-fixed tissues, stained by the aniline-blue connective tissue method, the nuclei of the blastomycetes are red, the cytoplasm is colorless, and the capsules are a light to deep blue so that they stand out with great sharpness. Upon application of the same technique to the tissue containing the *Histoplasma capsulatum*, it was found that every living organism contained a red-stained nucleus, and was surrounded by a narrow, pale to moderately intense blue capsule. All the vacuoles in the large, pale, phagocytic endothelial leucocytes were filled with empty capsules, which the cells evidently were unable to digest and get rid of.

The reaction of the body to the parasite, *Histoplasma capsulatum*, is exactly like the reaction to the infectious agents of leishmaniasis and leprosy. All three types of organisms are phagocyted by the endothelial cells lining blood and lymph vessels, and also by endothelial leucocytes. Within these cells the organisms proceed to multiply and develop. There is no evidence that they secrete a toxin strong enough to do any damage to the cells.

The lesions in the lungs are due to the presence of the parasites in the air sacs and bronchioles. They attract endothelial leucocytes, which phagocyte them and fill up the spaces. The organisms do not seem much more toxic than so much carbon, but they have the deadly property of multiplying and thus of attracting more leucocytes. In this way the lesions grow.

In the spleen the phagocytic cells distend the blood sinuses, and the leucocyte variety invades the lymph nodules. In the other organs involved, the lymphatics are also filled with phagocytic cells. The lesions in the liver seem to be the most destructive because they lead to necroses and sclerosis apparently as a result of blockage of the circulation by the accumulated phagocytes. In the intestines the nodules formed tend to break down and ulcerate.

How the organism of histoplasmosis invades the human body has not yet been determined. The case reported here would seem to suggest that it enters through the lungs, but these were not involved at all, in one of Darling's cases. On the other hand, the spleen and the liver were heavily infected in all previous cases, but not in ours.

It is suggested by da Rocha Lima that *Histoplasma capsulatum* is similar to *Cryptococcus farciminosus*, discovered by Rivolta as the cause of epizootic lymphangitis in horses, and regarded by da Rocha Lima as a yeast. Against this view is the active suppurative reaction caused by this organism, and indicating much greater toxicity.

Evidently further observations on other cases, and, most important of all, the obtaining of cultures, will be needed before the exact classification of the organism can be made. Owing to the frequent occurrence of lung lesions and the presence of parasites in the bronchioles, it would seem feasible to discover them in the sputum and to make a diagnosis during life—possibly also to obtain cultures.

SUMMARY

A report is made of a case of toxic cirrhosis of the liver which gave rise to a primary liver-cell carcinoma, and which was complicated by a terminal bronchopneumonia due to *Histoplasma capsulatum*, the fifth reported case of this disease as far as known. The organisms were found to be strongly Gram-positive, and by the use of the aniline-blue connective tissue stain, were shown to possess very definite capsules which remained behind in the phagocytic cells after the death of the parasites.

REFERENCES

1. Rowen, Henry S., and Mallory, F. B., *Am. Journ. Path.*, Vol. I, 1925, (p. 677)
2. Darling, Samuel T., *Journ. Exp. Med.*, Vol. XI, 1909, (p. 515)
3. Watson, Cecil J., and Riley, William A., *Arch. of Path. and Lab. Med.*, Vol. I, 1926, (p. 662)
4. da Rocha Lima, *Centralbl. f. Bakteriologie*, Orig. LXVII, 233

DESCRIPTION OF FIGURES

FIG. 1

Histoplasmosis of lung. Exudate within air sac: consists of endothelial leucocytes distended by phagocyted parasites. X 1000

FIG. 2

Histoplasmosis of lung. Two giant cells with many nuclei. The parasites have died and disappeared, leaving vacuoles in the cytoplasm. X 1000

FIG. 3

Histoplasmosis of lung. A typical giant cell containing several nuclei and many parasites lying within vacuoles. X 2000

FIG. 4

Tropical ulcer of skin. Endothelial leucocytes distended with numerous Leishman-Donovan bodies. X 2000

FIG. 5

Blastomycosis of lung. A giant cell containing several blastomycetes lying in vacuoles. Two are budding, and several show distinct capsules around them. X 1000

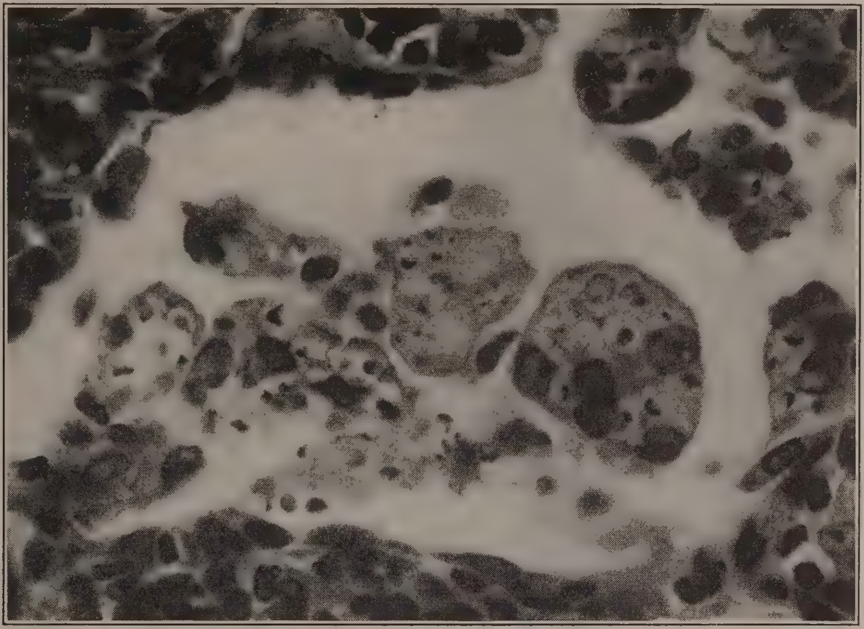


FIG. 1

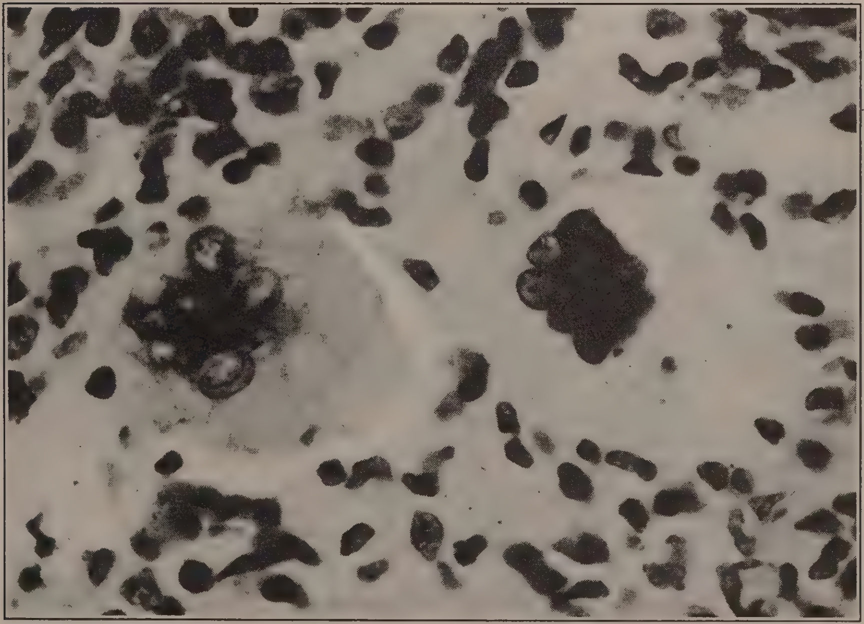


FIG. 2

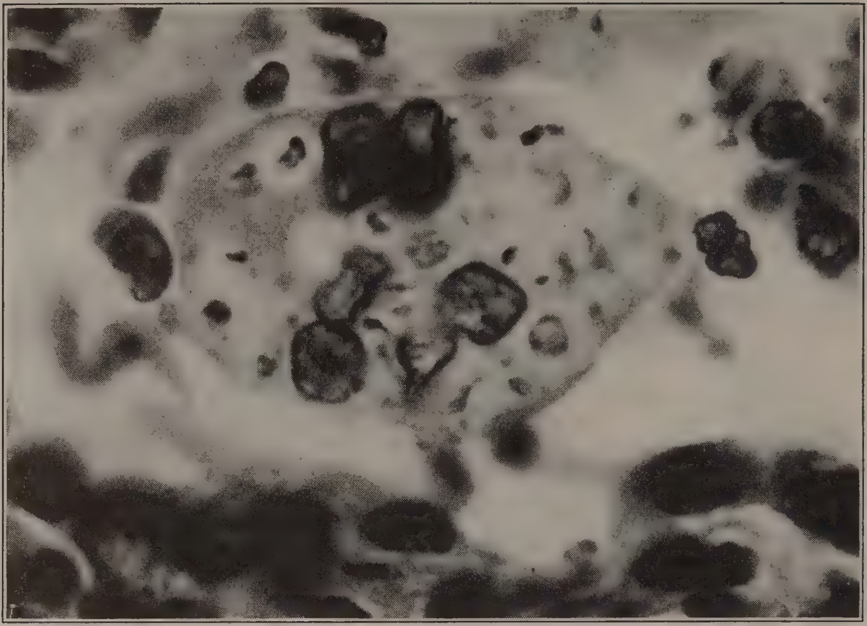


FIG. 3

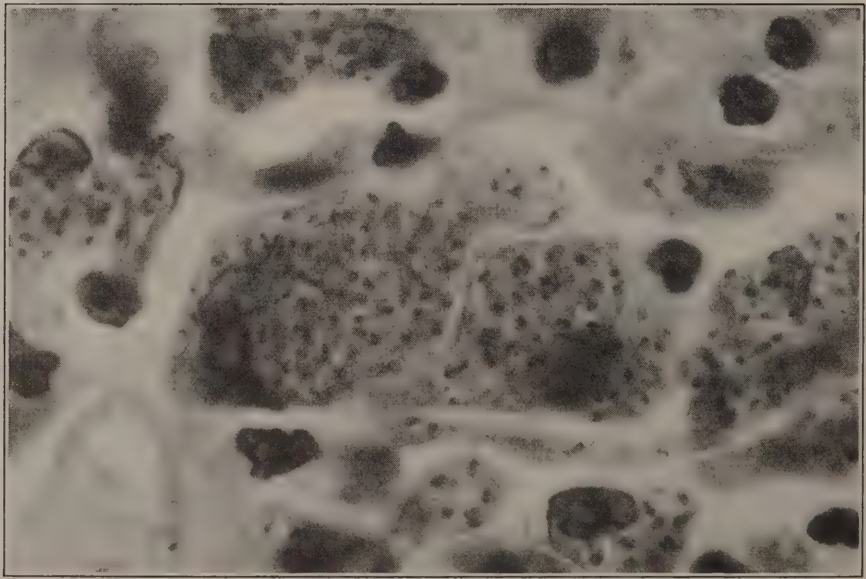


FIG. 4

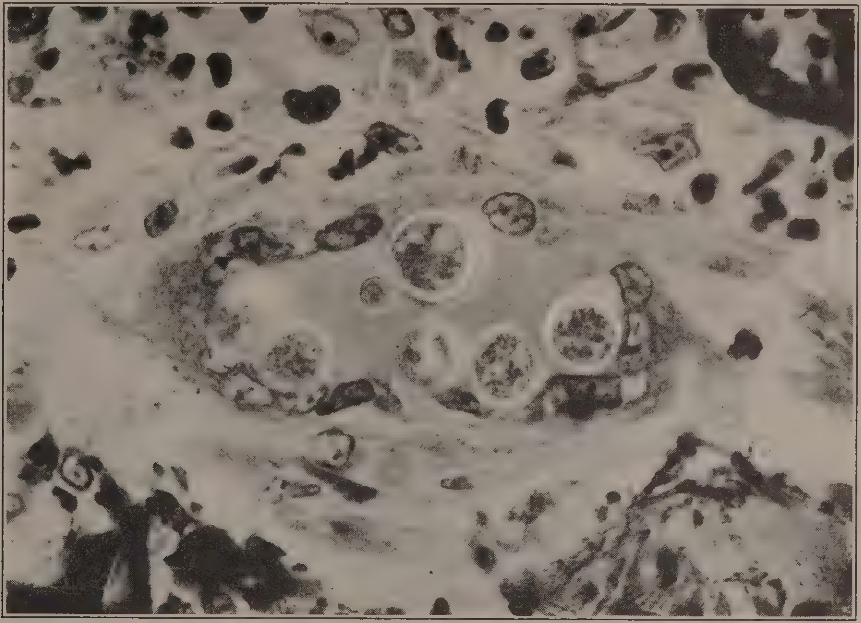


FIG. 5

CARAATE IN COLOMBIA

WALTER MENK, M.D.

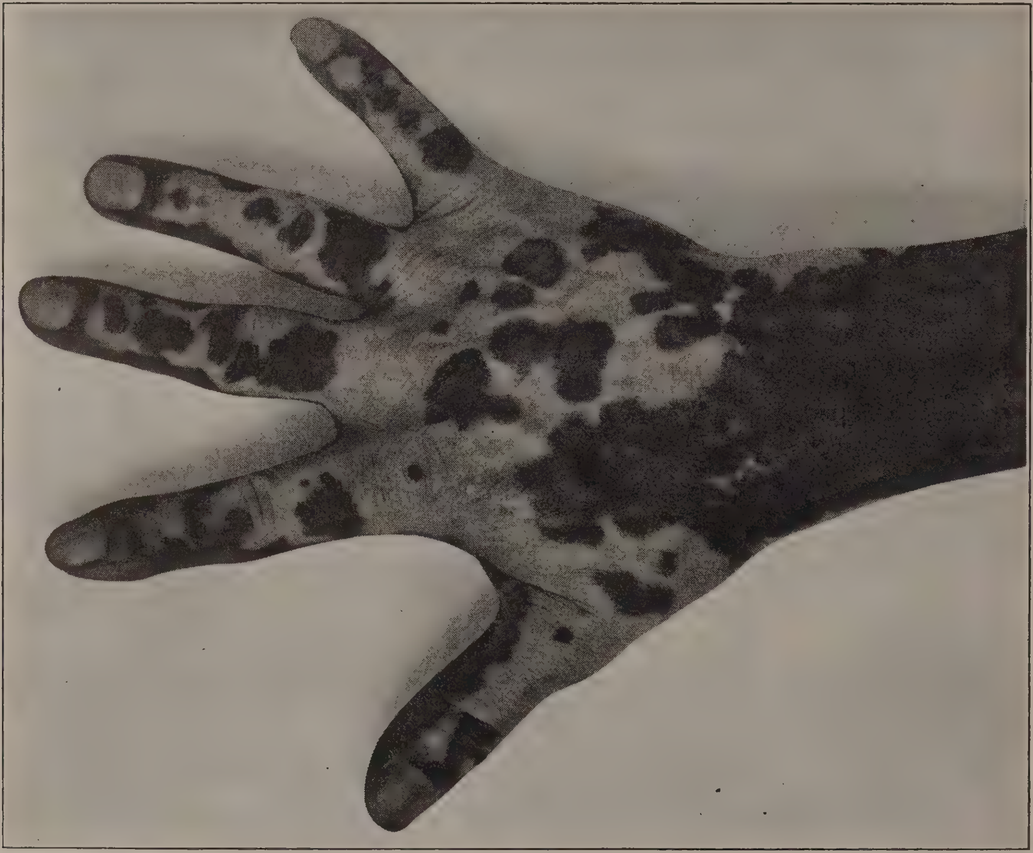
Santa Marta Hospital

Caraate is a very common disease of the skin among the laborers of this division of the United Fruit Company. The hospital records indicate that the incidence of caraate is about the same in Indians, negroes, and the mixed-race individuals. Our labor consists chiefly of the mixed-race class. Caraate is rarely, if ever, seen in a pure-white person. The disease is far more prevalent among the rural poor class than among citizens of high caste.

I observed about 500 hospital patients in the medical wards, from the beginning of September to the middle of December, 1926. More than 10 per cent of these had some variety of caraate.

According to Castellani[1], pinta (a synonym for caraate) indicates not a single disease but a group of closely allied dermatomycoses of various color, due to different species of fungi of the genera *Penicillium*, *Aspergillus*, *Monilia*, and *Montoyella*. He has based this definition on the work done by Gomez, Uribe, Ruiz y Sandoval, Montoya y Florez, and others. Recently there appeared a paper on caraate by A. Peña Chavarria and Paul G. Shipley[2]. According to these authors, mycelia are found in the epidermis, the glands of the skin, the hair follicles, and the cutis, as well as in the subcutaneous tissue. The stratum corneum was said to be almost free from the parasites and the authors never found mycelia in the depigmented skin.

Usually the varieties of caraate are classified according to the color of the lesions. Thus we have the more common black and white varieties, and the rarer forms of the blue, red, violet, and yellow types. Very often several varieties of caraate are observed at one time in the same individual, so that any kind of classification that is based on the external clinical appearance of the cases will be unsatisfactory. In some way, too, the different size, distribution, and extension of the hyperpigmented and depigmented areas in the skin are very characteristic and cause striking variations in the clinical pictures. I present some photographic illustrations of a few cases of caraate that occurred in my hospital series at Santa Marta.

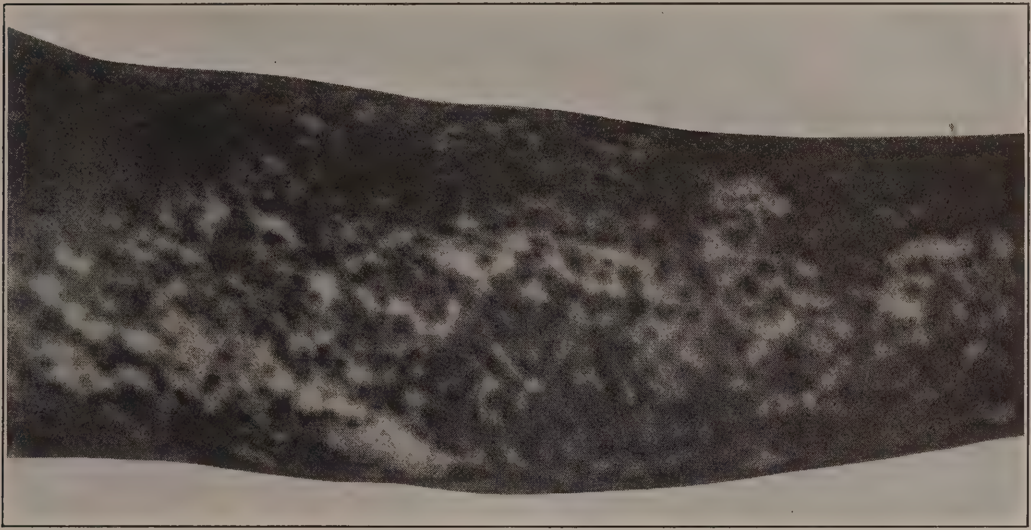


No. 1

PHOTOGRAPH 1

Case Number 2,900. — A brown laborer, 41 years of age. The spleen, liver, and epitrochlear lymph nodes were palpable. There was slight oedema of the legs. The haemoglobin estimation was 55 per cent, blood film negative for malaria, and the Wassermann test positive. The urine contained a large amount of albumin and casts. The stool contained ova of the hookworm and Trichocephalus.

Skin. — White caraate was present. There were multiple itching erosions of the epidermis. This case showed a typical salamander-like vitiliginous caraate on the hands, feet, knees, and elbows, while other large areas of skin were covered with a fine "pepper and salt-like" mottling.



No. 2

PHOTOGRAPH 2

Case Number 3,486. — A brown laborer, 30 years of age. The spleen was enlarged, and the patient was distinctly jaundiced. The haemoglobin estimate was 70 per cent, no malarial parasites were found, and the Wassermann test responded in an anticomplementary manner. A Widal test at 1 : 400 was positive against *B. typhosus.* The urine was negative to the usual examination. The stool contained *E. histolytica* and the ova of the hookworm and Trichocephalus.

Skin. — The picture of the forearm shows a finer mottled type of caraate, and one can see very dark and light brown patches forming a mosaic with depigmented or colorless skin.

PHOTOGRAPH 3

Case Number 3,565. — A brown laborer, 35 years of age. The spleen and epitrochlear lymph nodes were enlarged. The haemoglobin estimate was 75 per cent, there were no malarial parasites, and the Wassermann test was strongly positive. The urine was negative. The stool contained *E. histolytica*, flagellates, and the ova of the hookworm. Otitis externa was present.

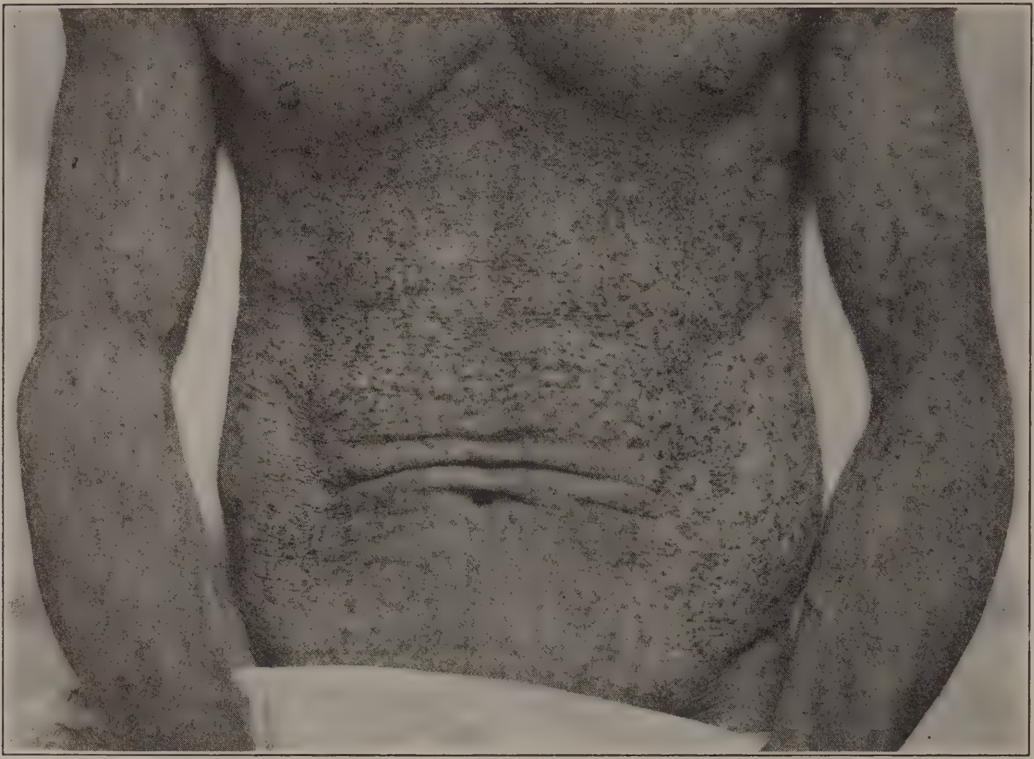
Skin. — There was a universal distribution of caraate in this case. The skin throughout small areas in both inguinal regions still maintained its original normal color.

On chest and abdomen there was white atrophic skin studded with yellowish-brown spots.

Face and upper arms showed skin of a muddy-grayish color.

On the fore-arms the skin had large, violet-grayish, livid areas that became gray on pressure.

The back was covered with a finely mottled skin that presented a diffuse greenish-yellow color.



No. 3

In the photograph (No. 3) is evident the abdominal distribution of the disease, an achromic background mottled with brownish spots.

The three cases thus far described are characterized by a leucodermic feature which represents the final stage of caraate. The next two pictures represent black caraate, or the early stage of the disease.

PHOTOGRAPH 4

Case Number 2,586. — A brown laborer, 22 years of age. All the superficial lymph nodes were enlarged. The haemoglobin estimate was 50 per cent and there were no malarial parasites, but the Wassermann test was strongly positive. The stool contained *E. histolytica* and some flagellates.

Skin. — Black patches of caraate were present on the face, buttocks, hips, and thighs. These black zones were formed by densely crowded, black, follicular lesions. A fine network of lighter color separated the follicles. These large black areas were surrounded by slightly depigmented skin. Vitiligo was noted on the elbows, hands, knees, and feet. The patient complained of an itching sensation, and this symptom was aggravated by the administration of neosalvarsan.

PHOTOGRAPH 5

Case Number 435. — A brown laborer, 30 years of age. He had the symptoms of chronic bronchitis. The liver and spleen were enlarged. No blood examinations of any character were recorded.

Skin. — There was black caraate of the face. This variety is very common. The face, in pronounced cases, resembles that of a chimney-sweeper (of a sooty, mouse or maltese color).

PHOTOGRAPH 6

This picture presents a group of three cases of caraate. All of the patients showed a roughly symmetrical white caraate (vitiliginous type). The case on the reader's right also has patches of black caraate on his face. The clinical features of these cases are listed as follows:

Case Number 2,752. — This man stands at the left of the reader. He was a brown laborer, 37 years of age. The liver was palpable. The haemoglobin estimate was 80 per cent, no malarial parasites were found, and the Wassermann test was strongly positive. The urine contained albumin, many casts, and red blood cells. The stool contained *E. histolytica.* Albuminuric retinitis was found.

Skin. — A case of white caraate that was stated to be 20 years old was evident.

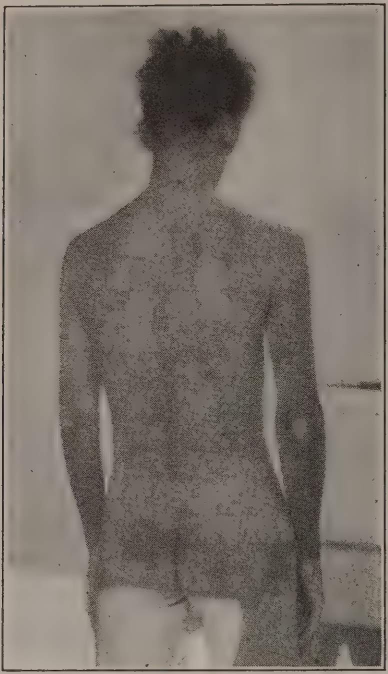
Case Number 3,348. — A brown laborer, age 41 years. This man stands in the middle of the picture. The liver was enlarged. The haemoglobin estimate was 60 per cent, and the blood film revealed aestivo-autumnal malarial parasites. The Wassermann test showed an anticomplementary result. The urine contained albumin and casts. Arteriosclerosis was recorded.

Skin. — There was a widespread, very old, white caraate.

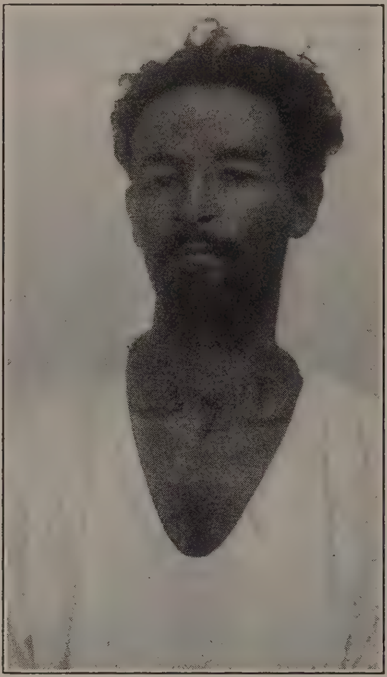
Case Number 3,473. — A brown laborer, age 48 years. This man stands at the right of the reader. The spleen, liver, and superficial lymph nodes were palpable. The haemoglobin estimate was 80 per cent. No malarial parasites were found, and the Wassermann test was strongly positive. The urine contained albumin and casts. The aorta was dilated.

Skin. — There was black caraate of the face and finely mottled caraate on the torso, as well as white, coarsely mottled caraate on the arms and legs.

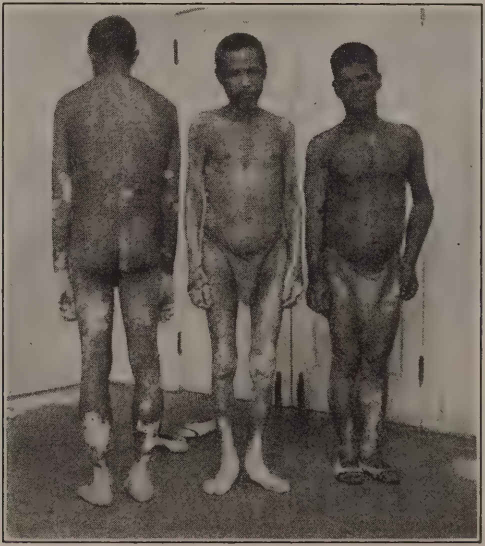
These diagnoses of caraate have been made clinically, because there are at present no satisfactory laboratory methods for its diagnosis. In regions where caraate is endemic, this diagnosis is applied to almost every skin disease in which persistent changes in the color of the skin is a prominent feature. The pigment in normal skin is not very stable. Repeated application of tincture of iodine, a mustard plaster, or other vesicant agent, as well as sunburn, is often followed by a marked pigmentation that may last for a long period. It is therefore conceivable that a number of so-called caraate cases, especially those showing a grotesque configuration and distribution of the lesions, are sequelae of a regular



No. 4



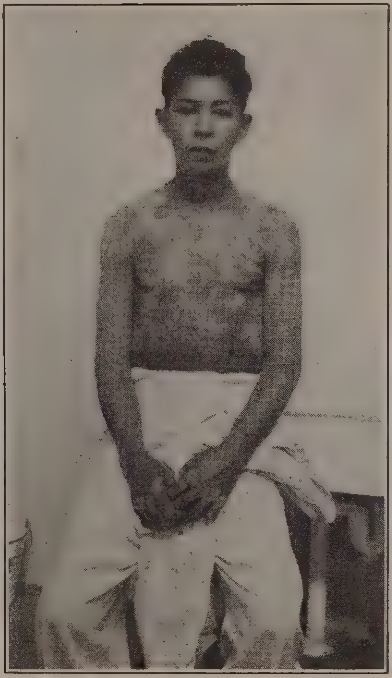
No. 5



No. 6

form of Tinea corporis. Such a condition is probably shown in Photograph No. 7. The localization and shape of the cutaneous lesions over the chest and shoulders closely resemble those of true Tinea corporis. The scrapings from the involved skin, in this case, did not show the characteristic fungi that are usually demonstrated with ease in a true case of active Tinea corporis.

The value of microscopical examinations of scrapings from the skin in cases of caraate is limited by several circumstances. Such specimens from the skin of these natives almost invariably show several kinds of fungi, but many cases of caraate fail to show fungi in impressively large quantities. Cases of white caraate rarely yield fungi and, even in comparatively fresh cases of black caraate, fungi are not regularly visible. It usually happens that the apparently diseased area in the skin is free from fungi, while scrapings from the apparently normal skin (taken as a control measure) show a large amount of fungi microscopically the same as that found in other cases of caraate.



No. 7

It is true, however, that the cases of black caraate yielded more abundant fungi than the other varieties. It seems remarkable that I have never been able to find mycelia in our cases of caraate that agree with the pictures associated with epidermophyton or trychophyton infections. I can further state that I have never been able to find fructification forms that resemble *Aspergillus* or

Penicillium. Of course, for scientific identification, the varieties of fungi we have found should have been subjected to differentiation on culture media, but a rigid technique and considerable experience with such methods would be required to eliminate the many non-specific fungi present in the scrapings from nearly every case examined.

Numerous varieties of fungi have been described as the cause of caraate. This is one circumstance that leads me to feel that the aetiology of caraate is still a debatable question. One must admit, nevertheless, that a large number of these cases of caraate (except those of vitiliginous character) did produce fungi in the skin scrapings in a quantity that suggests a mycosis in some way connected with the pathology of the disease.

The work of Pena Chavarria and Shipley indicates that the Wassermann test applied to cases of caraate is generally negative. My experience with our series of cases, however, is not in agreement with their statement. I applied the test to 67 classical cases of caraate with the following result:

69.5 per cent showed strongly positive Wassermann tests.
5.0 “ “ “ positive.
8.5 “ “ “ anticomplementary tests.
17.0 “ “ “ negative.

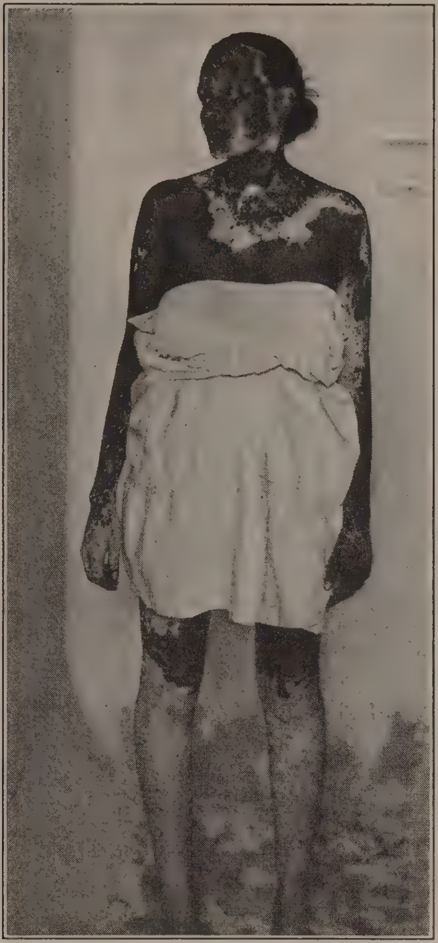
I am led by these results to think that the development of caraate is in some way related to an old treponematosis and that, at least, there is an association of aetiological factors, such as a treponematosis and mycosis occurring at the same time. In this connection it is interesting to note certain therapeutic support of this idea. Castellani states that the popular treatment in Colombia is the administration of mercury nitrate ointment. A number of physicians in Colombia have also told me about the good results they have obtained in the treatment of fresh cases of caraate by using neosalvarsan.

PHOTOGRAPHS 8 AND 9

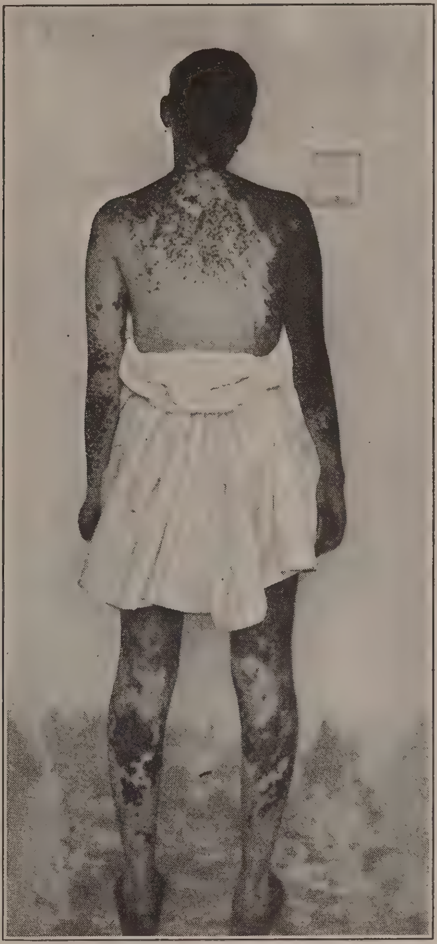
A case of white caraate observed by Dr. H. C. Clark during a malaria survey in the Colombia division, July 2, 1926. This young woman lived at Guacamayal, Colombia. She stated that the disease started in the hands and feet about two years ago. The skin itched at first and changed from the normal tan color to a maltese color. The scalp was extensively involved in her case. She was nursing a baby that was about six months old at the time this picture was taken. The child had a perfectly normal skin in appearance and it was a well-nourished baby.

REFERENCES

1. Castellani, A., and Chambers, A. J., “Manual of Tropical Medicine,” 1919, (p. 2,093)
2. Chavarria, A. Pena, and Shipley, P. G., “Caraate of Tropical America and Its Varieties,” *Arch. f. Schiffs-u. Trop.-Hyg.*, 1925, Vol. XXIX, No. 10, Oct. 15, 1925, (pp. 605–609)



No. 8



No. 9

GRANULOMATA TREATED WITH INTRAVENOUS TARTAR EMETIC
A REPORT OF FIVE CASES

W. A. HUTCHINSON, M.D.

Puerto Castilla Hospital, Honduras

Granuloma inguinale and dermal Leishmaniasis are not infrequently encountered among the natives and the West Indian negroes of Central America. Heretofore, the results obtained by the various local treatments that have been recommended were disappointing, and relapses frequently occurred in cases which had apparently been cured.

Since the introduction of tartar emetic in the treatment of these infections, we have used it for all cases in which Donovan bodies were present in smears, as well as for those which were suspected clinically.

All of the cases responded to the treatment, although one case of *Granuloma inguinale* showed a distinct tendency to chronicity.

Two of these cases were ulcers involving the pinna of the ear, and were both diagnosed clinically as dermal Leishmania infections, although they were not suspected as such on admission, and the diagnosis was not confirmed later when smears were examined for Leishmania. No doubt the local treatments that had been used prevented a positive finding in the smears. We have experienced no accidents, such as thrombosis of the veins, following the intravenous injections. Care, however, must be exercised to avoid infiltration of the tissues surrounding the vein, as this accident causes much pain, and may result in necrosis and sloughing at the site of the injection.

CASE REPORTS

Case 1. — Admitted July 17, 1926, and discharged September 19, 1926. History of swelling in left groin for 15 days, which broke down, leaving a sloughing ulcer. The patient was emaciated and very anaemic. There was a large fungating ulcer in the left groin, and a few smaller ulcers on the scrotum. The edges of the ulcers appeared to be constantly encroaching on the surrounding healthy skin. This patient remained in the hospital for 3 weeks under local and anti-syphilitic treatment, and his condition grew steadily worse. Although smears were made, and reported negative for Donovan bodies, we suspected the possibility of Granuloma inguinale and instituted tartar emetic treatment, beginning with 1 cc. of the 1% solution and increasing the dose 1 cc. each day until a dose of 10 cc. was given. The latter dose was continued daily for 10 days. Then the patient was discharged as able to work, and was told to report to the out-clinic for further treatments and observation. With the exception of one small, residual, healing ulcer, the lesions had entirely healed. Treatment was continued in the dispensary until healing was complete.

Laboratory reports. — Blood—negative for malaria
Meinicke test—negative for syphilis
Urine—a few pus cells
Stools—positive for uncinaria ova
Smears for Donovan bodies—negative

Case 2. — History of swelling, in left groin, which broke down (about two months prior to patient's admission to the hospital) forming an ulcer, which has enlarged considerably during the last week; several small ulcers have appeared on the scrotum.

Physical examination. — General nutrition fair; teeth in poor condition; moderate anaemia. There is a dirty ulcer in the left inguinal region. The odor is foul, and the edges are apparently extending, and involving healthy tissue. There are several small ulcers on the scrotum.

Treatment. — Dressings saturated with normal saline solution were applied locally for 3 days, during which time daily smears taken from the ulcer were examined for Donovan bodies; smears were reported positive on the 3rd day. The tartar emetic treatment was instituted with the same dosage as in Case 1, but later, on account of the patient's susceptibility and reaction, it became necessary to reduce the dose. The lesion began to heal after the 5th injection, and the patient was discharged on the 16th day, the lesion having completely healed. In this individual, the larger doses of tartar emetic caused pains in the joints, especially in the knees and shoulders. The pains were not severe, however, and lasted only a few hours.

Laboratory reports. — Blood—negative for malaria
Meinicke test for syphilis—negative
Urine and Stools—negative
Smears for Donovan bodies—positive

Case 3. — Jamaican negro, age 49 years, gave a history that his lesion began two years ago as a venereal sore on the penis, followed by a left inguinal bubo, which suppurated and formed a large inguinal ulcer. About 2 months later, he came to the hospital for treatment. The ulcer was cauterized, but failed to heal entirely. I saw him for the first time in September, 1924, when smears from the lesion were positive for Donovan bodies. Treatment with tartar emetic was instituted, with the method recommended by Dr. I. M. Gage[1]. There was rapid improvement, and the patient was discharged from the hospital able to work, with instructions to report to the hospital dispensary for observation and further treatment. On his last visit to the dispensary, there was a small area of the original ulcer which had not healed.

After a few visits to the clinic, he failed to return, and was not seen again until October 5, 1926. At that time, there was a long, narrow ulcer which extended the entire length of the femoral groove, down to its junction with the scrotum. The lesion was superficial, and exuded a profuse, odorless, watery secretion. There was little or no inflammation or induration of the skin surrounding the ulcer. The left inguinal lymphatic glands were enlarged, but not indurated. Near the frenum of the penis, there was a piece of retracted skin of the prepuce, which formed a tumor mass as large as the glans penis, and gave the appearance of a double glans. Posterior to the coronal sulcus, there was an ulcer which encircled the shaft of the penis. It had the same general appearance as the inguinal lesion.

Treatment. — As the smears in this case were formerly positive for Donovan bodies, the diagnosis was made at once, and 5 cc. of a 1% solution of tartar emetic was given intravenously every other day. Mixed treatment (KI and mercury) was prescribed and taken 3 times daily as an alterative. The patient remained under treatment in the hospital 28 days, and was discharged when all ulcers had completely healed. He has reported to the out-patient clinic at irregular intervals since leaving the hospital, and the lesions have remained entirely healed.

Laboratory reports. — Blood—negative for malaria
Meinicke test—negative for syphilis
Urine—negative
Stools—positive for Ascaris and Trichocephalus dispar ova
Smears from ulcers—negative for Donovan bodies (positive September, 1924)

Case 4. — A. C., native of Honduras, admitted to the hospital October 16, 1926, for treatment for an ulcer on the left ear, which began as a small blister about 4 months prior to admission. Examination revealed a large, shallow ulcer involving the skin over the entire posterior surface of the pinna of the left ear. Base of the ulcer was pale, and comparatively clean. Borders were indurated, and slightly raised. Surrounding skin was pigmented, and slightly thicker than normal. The inguinal, epitrochlear, and cervical lymphatic glands were enlarged.

Laboratory reports. — Blood—negative for malaria
No blood test for syphilis
Urine—a few pus cells
Stools—positive for ova of Ascaris lumbricoides and Trichocephalus dispar
Smears from ulcers—negative for Leishmania

Treatment. — On admission to the hospital, ammoniated mercury ointment was applied locally to the ulcer, and patient was given sodium iodide. As there was no improvement noted after 15 days had elapsed, a clinical diagnosis of dermal Leishmaniasis was made, and tartar emetic was prescribed, using a 1% solution and an initial dose of 2 cc. given. On alternate days the injection was repeated and the dose increased 2 cc. each injection, until a 10 cc. dose was given. At the end of 12 days on this dosage, the lesion was entirely healed.

Case 5. — A native of Honduras, male, age 25 years. He had had a sore on the right ear for 2 months, but could give no definite information as to its origin. Examination revealed a rather deep ulcer, with well-defined borders, which extended almost completely around the pinna of the right ear. Removal of a crust which partially covered the ulcer exposed a base that was covered with a foul, purulent exudate. There were a few small, shallow, crusted ulcers on the patient's legs and arms, which probably had no aetiological connection with the lesion on the ear.

Laboratory reports. — Blood—negative for malaria
Meinicke test—negative for syphilis
Urine—negative
Stools—positive for uncinaria ova

No smear from the ulcer on the ear was examined for Leishmania until two weeks after admission to the hospital. During this time, local treatments were used on the sore. The smears, when examined, were negative and the patient's condition had not improved. Tartar emetic treatment was instituted at this time, and 10 days later the patient insisted on leaving the hospital, and was discharged, with instructions to report to the out-patient clinic for further treatment and observation.

When he was discharged from the hospital, the lesion had nearly healed. He did not return to the clinic, but several weeks later he was admitted to the hospital for treatment for a machete wound of the knee. The ulcer on the ear had apparently made no progress towards healing after he left the hospital. Smears were examined for Leishmania, with negative results. He was again treated with tartar emetic. There was immediate improvement, and he was discharged from the hospital after the lesion had completely healed.

CONCLUSIONS

1. Granuloma inguinale and dermal Leishmaniasis probably occur more frequently in Honduras than is generally believed. The lesion is often not recognized.

2. Tartar emetic is apparently a specific.

3. A fresh, sterile, 1% solution of the drug should be used intravenously, beginning with a small dose, and increased gradually until the maximum dose of 10 cc. is given. The maximum dose is then usually tolerated without any apparent ill effects.

4. Treatment should be continued for a time after apparent cure, to avoid recurrence.

REFERENCE

1. Gage, I. M., *Archives Derm. and Syph.*, Vol. VII, March, 1923

NOTES ON GOITER

JAIME DE LA GUARDIA, M.D.
United Fruit Company Hospital, Preston, Cuba

Goiter in this region of Cuba is not common. Three cases have come under my observation in the last three years, all of which were of the toxic type. Two of the cases had all the signs and symptoms of Graves' disease. The symptoms in the other case were comparatively mild, although there was a marked post-operative reaction, toxic in character, which apparently could not have been produced by a non-toxic goiter.

We lost one of our cases, that of a man of 40 years of age who had lost 60 pounds' weight within 2 months, and who presented all the symptoms and signs of a far-advanced case of hyperthyroidism (Fig. 1). As a preparatory pre-operative measure, he was put to bed, an ice-bag was applied to the heart; at night, to secure sleep, luminal, 1½ grains, was given. Potassium bromide, gr. 10, and Lugol's solution, 5 mm., were given 3 times a day. He showed a slow improvement; at the end of 30 days he had gained 3 pounds, and the pulse rate had dropped from 140 to 100. His general condition was apparently improved, and we decided to operate. The operation was done without much difficulty. In

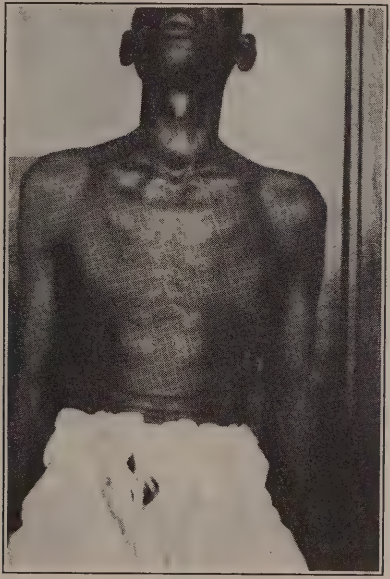


FIG. 1
Fig. 1 shows a case which we lost. Note pronounced emaciation, typical of far-advanced cases of hyperthyroidism.

this case, the ribbon muscles were divided and the right lobe and part of the isthmus were excised. The post-operative period was stormy. The temperature went up to 104° F. the day after the operation, the pulse became weak and thready, and the patient showed all other symptoms of a profound toxaemia. Saline infusion, large doses of digitalis, and cold packs to reduce temperature, were of no avail. He died on the 4th day following operation.

In this case we used no Lugol's solution after the operation. The wound was closed and a small drain was inserted. These two facts are mentioned in order to emphasize the mistake of not carrying out, in this case, the procedure that De Courcy* of Cincinnati follows in operating and treating his toxic cases.

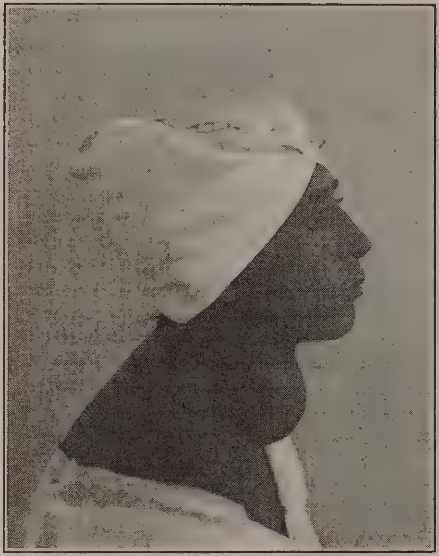


FIG. 2

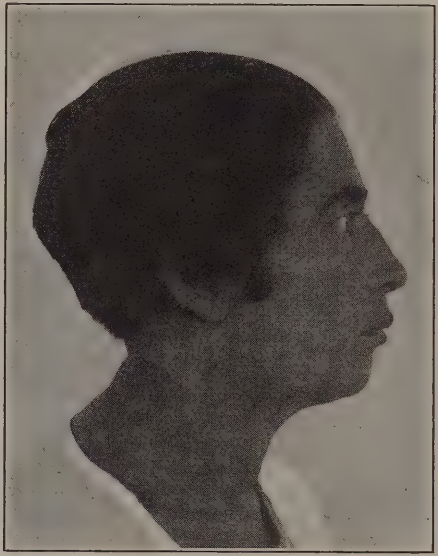


FIG. 3

Figs. 2 and 3 represent our last case, before and after operation. Patient has gained seventeen pounds in last two and one-half months and is quite well.

As to the operation *per se*, both lobes should be excised, irrespective of their size, leaving behind, of course, enough of the gland to carry on its function. The cavity is lightly packed with gauze saturated in normal saline solution, and the wound is left wide open. The next important point is the administration, by rectum, immediately after the operation, of 30 minims of Lugol's solution, which should be repeated in 6 hours. More than 30 minims may be given if necessary. Secondary suturing of the wound should not be done until the temperature comes down to normal and the toxic symptoms have abated. In our last case, we carried out this plan, and in spite of a serious post-operative reaction, which lasted 4 days, the patient responded very definitely to the treatment and made a

---

*Article by De Courcy in *Annals of Surgery*, August, 1925 good recovery. We believe that the De Courcy technique, carefully followed, is an essential factor in getting favorable results.

Conclusions. — There appears to be a low incidence of goiter in this part of Cuba, and from information gathered from the available local medical literature there seems to be no goiter region on the Island.

De Courcy operative technique and post-operative treatment as outlined above is recommended.

REPORT OF A CASE OF GYNATRESIA

RICARDO AGUILAR, M.D.

Quirigua Hospital, Guatemala

As an unusual gynecological condition, and on account of the indefinite aetiology in this instance, I report the following case of gynatresia:

History. — A colored woman, age 19, was admitted to Quirigua Hospital on January 10, 1927, with the following history: Dysmenorrhoea since puberty, but menstrual periods were regular. Leucorrhoea had been persistent, and was worse since her marriage two years ago. Sexual contact was painful, and she complained of constant slight pains radiating from the lower abdomen to the back.

Physical examination. — External genitalia showed a normal vulva, with evidence of hymen remains. The vaginal cavity was about 1½ inches long and ended in a vaginal septum, in which there were two small openings situated laterally, and through which a director could be passed for about half an inch toward the cervix.

A bimanual rectal examination of the uterus showed it to be apparently normal in size and position — also the adnexa. A recto-vaginal examination, the fundus of the uterus being held with the rectal finger, was made, and the cervix could be palpated through the abnormal septum that formed the vaginal vault.

Operation was performed on January 12th, under stovaine spinal anaesthesia.

The membranous septum was incised and the cervix freed from its adhesions to the vaginal vault. The free edge of the incised septum was then sutured to the denuded vaginal wall at the fornices with interrupted catgut sutures. A light gauze vaginal pack was inserted, and removed on the 3rd day.

The patient was discharged in good condition on the 13th day after the operation.

This condition is usually congenital, and accompanied by other abnormal development of the genitalia, such as absence or atrophy of the uterus and adnexa. In this case, although no history of vaginitis occurring in childhood could be elicited, it is quite possible that it was the result of a local inflammatory disease existing early in life and resulting in adhesions of the vaginal mucosa, thus causing the gynatresia.

SODIUM THIOSULPHATE IN BICHLORIDE OF MERCURY AND ARSENICAL INTOXICATIONS—REPORT OF THREE CASES

MANUEL D. ROJAS, M.D., PH.C.

After the valuable publication of Kuhn and Reese[1], on the use of sodium thiosulphate in the treatment of metallic intoxications, I have had the opportunity of observing its favorable influence in two cases of acute bichloride of mercury poisoning and one case of a severe attack of dermatitis exfoliativa, following a course of arsphenamine treatment.

As stated by Haskell, Henderson, and Hamilton[2], it was Dennie and McBride[3], following the suggestion of Ravaut, who led them to advocate the use of sodium thiosulphate as an antidote for a whole group of toxic metals. There is not, as yet, a clear understanding as to the manner in which sodium thiosulphate is capable of neutralizing metallic poisons; it cannot be explained on the basis of purely chemical reactions of oxidations and reductions. Reviewing the comments of Kuhn and Reese, we note that the administration of sodium thiosulphate is followed, in the case of arsenic intoxication, by an increase in the excretion of this metal in the urine, due in part to the diuresis produced by the sodium thiosulphate. In the case of bichloride of mercury poisoning, one of the most striking effects of this treatment has been the prompt disappearance of albumin and casts from the urine. Furthermore, other experiments have demonstrated that it hastens the restoration of the normal kidney functions.

We are told by Nyiri[4] that sodium thiosulphate in the body is oxidized to sodium sulphate and a molecule of sulphur is liberated; and Hottinger[5] has pointed out that sulphur in the body may also play a rôle in biological oxidation,—this may be considered a probable explanation for its action.

Reports of 3 cases follow: Case No. 1—a severe acute bichloride of mercury poisoning—is of special interest. It is a well-known fact that the prognosis of acute bichloride of mercury poisoning depends upon the amount of chemical ingested and the promptness with which the case is treated.

Haskell, Henderson, and Hamilton[2] report that Burmeister and McNally found a large amount of mercury present in the blood of a dog within 3 minutes after a massive dose of bichloride of mercury had been placed in the stomach of the animal, and that in this lapse of time "irreparable kidney parenchyma degeneration" had been produced. Case No. 1, described below, swallowed 3 tablets, containing 22 grs. of bichloride of mercury, and was not given proper attention until the following day. The incident happened 7 months ago; the patient is now perfectly well, and there remains no evidence of oesophageal stricture or kidney damage. It is probably not fair to attribute all credit to the sodium thiosulphate treatment alone, as other measures, good luck, and the patient's exceedingly strong resisting body tissues, also contributed to her recovery. This particular case, however, has left with me the strongest impression as to the beneficial influence of sodium thiosulphate treatment in metallic intoxications.

In order that the report of these cases may be of some practical importance, I will first review the method of administration of sodium thiosulphate. Kuhn and Reese[1] recommended the intravenous administration of a 5% solution; 10 cc. of the solution contains 0.5 gm. of sodium thiosulphate; they follow Dennie and McBride[3], who give 0.3 gm. of sodium thiosulphate intravenously the first day; the following day 0.45 gm.; the 3rd day 0.6 gm.; the 4th day 0.9 gm.; the 6th day 1.2 gm.; and the 8th day 1.8 gm.

In very oedematous cases they use also the oral administration: 2 gms. of the sodium thiosulphate daily in 120 cc. of physiological sodium chloride solution. The object of the sodium chloride solution is to decrease the vomiting, which occasionally results from the oral administration.

In bichloride of mercury poisoning, I have given a daily intravenous injection of 10 cc. of the 5% solution, which is equivalent to 0.50 of the sodium thiosulphate, plus 1 gm. of sodium thiosulphate by mouth, morning and night, dissolved in 100 cc. of iced milk.

This chemical is well tolerated by the stomach when given in milk; it was not followed by vomiting.

Case No. 1. — A woman, age 24, was admitted to the hospital May 6, 1926. Her parents stated that the day before, the girl had swallowed 3 tablets of 7½ gr. each of bichloride of mercury, and that as a first aid to the patient they had given milk and lemon juice and the patient had vomited freely. She is a well-developed female, weight about 155 pounds. On admission the patient evinced much excitement, had an anxious expression, and complained of violent pains in the stomach which were accompanied with severe vomiting. There was marked oedema and erosion of the lips; the tongue was red and swollen; the teeth were carious and very tender; and a fetid breath, sponginess of the gums, and excessive salivation were present. Marked tenderness over the epigastrium was noticeable, the extremities were cold. The pulse rate was 139 and the respiration 21 per minute. The condition of the oral mucous membrane was so bad that it was impossible to wash out her stomach.

About half an hour after admission the patient passed from a state of excitement to one of almost complete collapse. Hot-water bags were applied, and an injection of 1/50 gr. of digitaline was given. Her mother stated that the patient had voided no urine since swallowing the poison. About 1 hour after the injection of digitaline, 0.50 gm. of sodium thiosulphate was given intravenously. The patient did not void, the whole day, but passed bloody mucus from rectum. About 5 o'clock in the evening she was screaming and complained of excruciating pain and tenderness on pressure over the epigastrium; a hypodermic ¼ gr. of morphine and atropine was given, and she rested for the night.

The following morning sodium thiosulphate 0.50 gm. was given intravenously, and in the afternoon she voided 90 cc. of highly colored urine containing large quantities of albumin, casts, and red blood cells. At 6 P.M. 1 gm. of sodium thiosulphate was given in 100 cc. of iced milk, and was well tolerated.

The third day 0.50 gm. of sodium thiosulphate was given intravenously, and 1 gm. by mouth, dissolved in milk. At noon she passed 130 cc. of urine similar in character to that of the previous day.

From the 4th to the 12th day, the administration of sodium thiosulphate was repeated, viz., 0.50 gm. intravenously, and orally 1 gm. dissolved in 100 cc. of iced milk, morning and night. The quantity and quality of the urine did not change until the 9th day, when she passed 180 cc. at one time, the red cells had disappeared, the albumin was less, and casts were fewer. From the 1st to the 8th day, she passed frequently bloody mucous stools. Beginning on the 12th day, she began to void average normal amounts of urine, still containing albumin. The last traces of albumin were detected on the 21st day.

All lesions from the mouth and stomach apparently cleared up, and the patient was discharged on the 23rd day after admission, feeling quite well, except for slight weakness and signs of secondary anaemia. She was taken to another part of the country for a change, and I have been informed by one of her relatives that she is in good health.

Case No. 2. — A carpenter, age 23, took 2 tablets of bichloride of mercury, with suicidal intent. He was admitted to the hospital August 12, 1926, at 10 P.M., 45 minutes after he had swallowed the tablets. The patient was very excited and complained of severe abdominal pain. Mouth and tongue were red, teeth and gums tender, and there was excessive salivation.

On admission to the hospital, lavage of the stomach was performed immediately, and some bluish-colored residual bichloride of mercury was removed. Intravenous injection of 0.50 gm. of sodium thiosulphate was given immediately, followed by the oral administration of 1 gm. of sodium thiosulphate dissolved in 100 cc. of iced milk. A hypodermic of ¼ gr. of morphine and 1/150 gr. atropine was also administered.

The next day the patient was less excited, but still complained of pain in his stomach. The sodium thiosulphate treatment was repeated. At 9 A.M. catheterization was necessary, and 190 cc. of urine were removed. This urine contained albumin, a few red cells, and granular casts. The patient did not void in a natural manner for 6 days, and it was necessary to catheterize him daily. Sodium thiosulphate treatment was continued until August 21st, when he was discharged, apparently well. Casts and albumin had disappeared from the urine.

Case No. 3. — A watchman, age 43, contracted syphilis in 1910 and was treated only for a period of 3 months. He stated that he had not received any injections. In March, 1926, he came to the dispensary and consulted me for a severe headache from which he had been suffering for the past 3 months.

After the necessary examination, including a Wassermann which was three plus +++, I decided to give him anti-syphilitic treatment. On March 28th, he received 0.30 gm. of arsphenamine, and a few minutes after the injection he developed an urticarial-like rash of the face, neck, and upper part of chest; this was relieved by an injection of 0.3 cc. of solution of adrenalin chloride, 1 to 1,000, and the condition cleared up in a few minutes. The same condition was observed after the 2nd, 3rd, and 4th injections.

On April 29th, following injection of 0.90 gm. of arsphenamine, the rash developed all over the body and the adrenalin had no effect.

On April 30th, the patient was admitted to the hospital, stating that he was not able to sleep during the night on account of the severe itching; oedema and redness were noticed all over the body. In the afternoon he had a chill and vomited several times. The urine contained traces of albumin. On May 1st, the skin was very hyperaemic, with slight inflammatory infiltrations, and he had a temperature of 100° F. On May 7th I noticed characteristic exfoliative features: — Various-sized flakes and slightly imbricated scales began to appear.

It was not until May 8th that I began the sodium thiosulphate treatment, which the patient received daily for a period of 10 days. Following the 2nd day of sodium thiosulphate treatment, the symptoms began to subside and the itching disappeared. On May 16th he was discharged; complete recovery of the dermatitis had taken place.

SUMMARY

Two cases of acute bichloride of mercury poisoning, in which absorption of the chemical had already taken place, were saved and the beneficial action of sodium thiosulphate was noted. The itching and dermatitis which sometimes follow the administration of arsenical preparations were also relieved by sodium thiosulphate.

The cases reported were in the United Fruit Company Hospital, Port Limon, Costa Rica.

REFERENCES

1. Kuhn, H. A., and Reese, H. H., "Sodium Thiosulphate in Treatment of Metallic Intoxications," *Journ. Am. Med. Assn.*, 85: 1,804 (Dec. 5), 1925
2. Haskell, C. C., Henderson, W. C., and Hamilton, J. R., "Sodium Thiosulphate in Mercurial Poisoning," *Journ. Am. Med. Assn.*, 85: 1,808 (Dec. 5), 1925
3. Dennie, C. C., and McBride, W. L., "Treatment of Arsphenamine Dermatitis and Certain Other Metallic Poisoning," *Arch. Dermt. and Syph.*, 7: 73 (Jan.), 1923
4. Nyiri, W., "The Fate of Sodium Thiosulphate in the Organism," *Biochem. Ztschr.*, 141: 160 (Sept. 20), 1923
5. Hottinger, A., "The Mode of Action of Sulphur," *Schweiz. med. Wchnchr.* 4 : 429 (April 26), 1923

CASE REPORTS OF *B. TYPHOSUS*, *B. PARATYPHOSUS*, AND *B. COLI* INFECTIONS, COMPLICATED BY TROPICAL DISEASES

O. T. Brosius, M.D.

Almirante Hospital, Panama

CASE No. 1

An Atypical Temperature in a Case of Typhoid Fever

The case is that of a young Italian lady, age 22—family history and past history unimportant. Patient entered hospital complaining of having had fever for one week, with headache and malaise. The fever became gradually worse, in spite of considerable quinine that she had been taking.

Physical Examination. — Patient well developed, but somewhat undernourished. The only positive findings were: (1) Fever with an accompanying low pulse rate, (2) An enlarged spleen, and (3) Rose spots over abdomen and on both arms.

Laboratory Reports

1. About 15 urine examinations were made throughout the course of the disease, and all were absolutely negative.
2. The stool examination showed uncinaria, ascaris, and trichocephalus.
3. White blood count, 7,500
4. Haemoglobin, 70 per cent
5. The Board of Health Laboratory, of Ancon, returned a report on the blood serum agglutination test as positive for B. typhosus 1/320, and negative for paratyphosus A. and B.

The fever which had risen to a maximum of 103° F. came down by lysis, reaching normal on the 12th day after admission. The temperature remained normal for 8 days, when it rose again to 100° F., reaching 101° on the following day. Again the temperature came down by lysis, reaching normal on the 27th day, but, on the 30th day it once more shot up to 102° F., and up to 103° on the 31st day. It then dropped again by lysis, reaching normal on the 36th day, when, except for a few little rises to 99° F. and once to 100° for one day, it remained down until the day of the patient's discharge from the hospital, 57 days after her admission.

CASE No. 2

Report of an Atypical Case of Paratyphoid A., with Complications

Mr. P., American, age 28, very well developed and well nourished. His family history, as well as his past history of illness, is unimportant and has no bearing on the present case. He had been on exploration duty along the west coast of Colombia, and had made several trips inland, frequently camping in the jungle at night and often compelled to live under very unsanitary conditions. He arrived at Almirante on November 18, 1925, and was admitted to the hospital on the same day, with a temperature of 99° F. He stated that he had been ill for 8 days with fever, malaise, weakness, severe headache, and slight cough—also that his condition had been ushered in by a violent chill. Thereafter he had taken a little quinine, off and on; he did not remember how much. That same evening his temperature rose to 102° F.

The only abnormal findings elicited on physical examination were: the fever, the comparatively high pulse, the coated tongue, and the enlarged spleen.

Blood Examination

Benign tertian parasites present in blood
White blood count, 8,000
Red blood count, 4,050,000
Differential white blood count:

	Per Cent
Polymorphoneutrophiles	71½
Large mononuclears	10½
Lymphocytes	16½
Eosinophiles	½
Transitionals	1

A marked polychromatophilia was noted in the blood smear.

Urine examination. — Specific gravity, 1.026; acid reaction, and otherwise negative in every respect.

Stool examination. — Negative.

On November 21, 1925, the patient suffered a violent chill, lasting 10 minutes. Quinine dihydrochloride was then administered intravenously, grs. 15. The fever continued. On November 23, 1925, tertian gametes were still found in the blood smear, in spite of the fact that the patient had been taking 15 grains of quinine bisulphate, 3 times a day, but the differential count had changed to the following:

	Per Cent
Polymorphoneutrophiles	62 2/3
Large mononuclears	8 2/3
Lymphocytes	22
Eosinophiles	2/3
Mast cells	1/3
Transitional cells and myelocytes	5 2/3

On November 30th the fever rose to 104.4° F., following a violent chill. Because, in my experience, I had had excellent results in the treatment of persistent cases of malaria with neosalvarsan*, I now gave .6 gram of this drug intravenously. The temperature dropped to 98° F. within 8 hours, and the patient felt considerably better.

On December 1st, however, the temperature rose again to 103° F., and so continued. A blood serum specimen was sent to Ancon Hospital at this time, and was reported positive for paratyphoid A up to a 1/320 dilution.

The temperature continued high without touching normal, until December 24th, after which time it came down to normal almost every day, but always rose again to between 102° and 103° F. On January 13th the temperature again became normal, abruptly, from 101° F. and remained down, leaving the patient weak, exhausted, and emaciated after more than 2 months of constant fever.

On December 7th the quinine was definitely discontinued. On December 9th the patient developed a dry, hacking cough, and a few sibilant and sonorous râles were scattered over both chests.

On December 29th, the white blood count was 7,800.

On January 6th, pus cells were first noticed in the urine, accompanied by a faint trace of albumin. Both the pus cells and albumin disappeared in a few days.

The temperature remained absolutely normal from January 13th until February 4th, when it suddenly shot up to 105.5° F. At this time the patient complained of a dull, aching pain in the lower right back (over the right kidney region) radiating to the abdomen.

The blood smear was negative for malaria.

The differential white blood count was:

	Per Cent
Polymorphoneutrophiles	60
Large mononuclears	11
Lymphocytes	23
Eosinophiles	3
Transitional cells	2
Mast cells	1

---

* Reported in *Am. Journ. Trop. Med.*, Jan., 1925

On February 5th and 6th the urine showed only a few pus cells and a few calcium oxalate crystals, but on February 8th the sediment showed pus (++) and on the following day pus (+++), clearly indicating the presence of pyelitis. The centrifuged specimen was stained and examined, and found to be full of Gram-negative bacilli. Acid-fast bacilli were sought repeatedly, but none was found. The temperature again came down to normal on February 19th; the pus in the urine gradually diminished, and finally disappeared.

After a 3-months' vacation, wherein the patient improved considerably, he returned to Almirante and on August 2nd was again admitted to the hospital for a return of the pyelitis. He remained in the hospital only 4 days, as he requested to be treated in the out-patient clinic, but he had to be readmitted on September 8th because of haematuria complicating the condition.

After remaining in the hospital only 8 days, he again urgently requested his discharge, and his treatment was resumed in the dispensary clinic.

CASE NO. 3

This is a case that died of typhoid fever in this hospital. The accompanying picture (page 145) of one of his kidneys at autopsy illustrates a renal condition represented by metastatic typhoid abscesses, which caused the constant finding of pus in his urine specimens, as well as the haematuria that complicated his fatal illness. A similar diagnosis would most probably apply to the foregoing case (No. 2).

CASE NO. 4

A Condition Frequently Complicating Tropical Diseases

B. Coli Infection of the Kidney

Panamanian, male, age 26—non-employee.

Family History. — Unimportant.

Past History. — Has suffered many attacks of malaria, and has also had urethritis complicated with prostatitis, as well as the primary lesion of lues, for which ample treatment had been already given and for which he was still being treated.

Present History. — He appeared first in the out-patient clinic, where he received treatment for tertian malaria, on positive blood findings, but, as the fever continued, he was admitted to the hospital. He had been drinking heavily for some time and was badly "run down," suffering a complete loss of appetite and nausea.

Physical Examination. — Small man, fairly well developed; under-nourished; and cachectic appearance. The positive findings were:

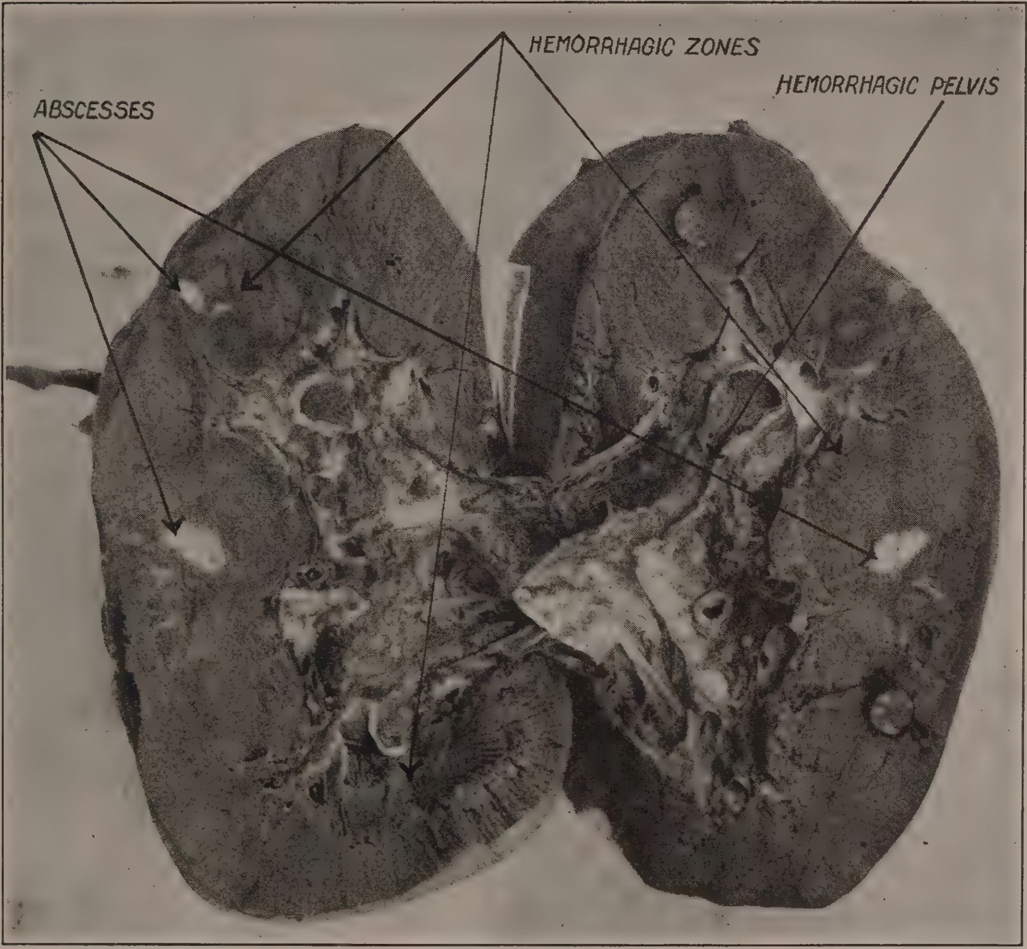
1. High fever, with accompanying low pulse rate
2. Tongue showed a brownish coat.
3. Spleen palpable
4. Intense tenderness over both kidney regions
5. Skin slightly jaundiced

Laboratory Reports

Urine—Albumin—faint trace, Pus (++)
Stool—Uncinaria and trichocephalus
White blood count—20,000
Haemoglobin—70 per cent
Differential white blood count:

	Per Cent
Polymorphonuclear	81
Large mononuclears	3
Lymphocytes	8
Transitional cells	7½
Eosinophiles	½

Prostatic smear, negative for microorganisms
Sediment from urine showed large numbers of B. coli.



KIDNEY OF CASE NO. 3

Meinecke test, (+) positive
Widal test, as reported by the Board of Health Laboratory, Ancon, was:
Negative for B. typhosus, B. paratyphosus A. and B., and B. dysenteriae.

After the diagnosis, caprokol or hexylresorcinal, and urotropin were both extensively used, and on the 25th day of the patient's illness mercurochrome (10 cc. of a 1% solution) was injected by vein. It produced a violent diarrhoea and extreme soreness of the mouth and gums, with excessive salivation, but seemed to produce a beneficial effect, as the subsequent recovery was uneventful, up to the time of his discharge, on the 43rd day after his admission to the hospital.

INCIDENCE OF *B. PARATYPHOSUS A* AND *B* IN STOOLS

WALTER MENK, M.D., AND J. C. REGISTER, Laboratory Technician
Santa Marta Hospital, Santa Marta, Colombia

This is a report of the incidence and local distribution of *B. paratyphosus A* and *B* in the city of Santa Marta, and in the banana zones of the United Fruit Company, Colombia Division, as determined by a bacteriological examination of stools in the hospital at Santa Marta.

The bacteriological investigation of typhoid and paratyphoid fevers in past years was confined almost exclusively to performing blood cultures and agglutination tests on cases of suspected paratyphoid and typhoid fever. In the present instance we cultured (Feb. 10 to Aug. 31, 1926) a series of 529 stools at the Company hospital. All of the stools were from patients in the hospital, and none of the cultures were repeated.

The technique used was the spreading of the stool specimen on Endo's medium. Suspicious colonies were then picked off these plates, and transfers were made to Russell's double sugar medium. Further identification of suspected colonies was made by the use of glucose, lactose, saccharose, maltose, mannite, and litmus milk media, as well as by a test for motility, a staining by Gram's method, and the use of agglutinating sera.

Of the 529 stool specimens examined 18 were positive for *B. paratyphosus A* (3.4%), and 20 were positive for *B. paratyphosus B* (3.8%), or a total of 38 positives (7.2%).

Sevilla District showed the highest rate of positive cases. The distribution by towns and districts was as tabulated below:

Location	*B. paratyphosus A*	*B. paratyphosus B*	Total
Santa Marta (city)	2	5	7
Rio Frio (District)	0	1	1
Sevilla "	9	5	14
Aracataca "	5	7	12
Santana "	2	2	4
Totals	18	20	38

The analysis of the positive cases by farms and departments in the districts of Aracataca and Sevilla shows the following distribution, and the population for the areas:

SEVILLA DISTRICT

	Construction Department	Augustina Farm	Florida Farm	Paulina Farm	Total
B. paratyphosus A	1	1	5	2	9
B. paratyphosus B	1	0	4	0	5
Population	40	50	200	150	440

ARACATACA DISTRICT

	Antioquia Farm	Camito Farm	Chile Farm	Magdalina Farm	Montagua Farm	Patia Farm	Total
B. paratyphosus A	0	1	0	0	2	2	5
B. paratyphosus B	1	0	2	2	1	1	7
Population	300	200	170	180	150	250	1,250

To the best of our knowledge, this is the first work of its kind that has been done in this locality.

A CASE OF CLONORCHIOSIS

WILHELM CORDES, M.D.

Preston, Cuba

Lon Chon, Chinese, age 38 years, was admitted to this hospital with malaria. He was born and raised in Canton, and came to Cuba 8 years ago. He complained of indigestion and pains in the upper abdomen for a period of several months, and in the last few days fever and headache as well.

Status. — Poor nutrition, skin and mucous membranes pale, face looked puffed-up, no leg oedema, no glandular enlargements; heart, normal outlines, action regular, blood pressure 140/80; lungs, bronchial râles; abdomen slightly distended, evidence of ascites; liver painful on pressure, its lower margin extending to 1 inch above umbilicus; spleen palpable and hard.

Blood. — Haemoglobin 55%, basophilia of erythrocytes, thick drop showed few rings of aestivo-autumnal malaria; W. B. C., 11,200; Diff. B. C., polynuclears 31, staff-nuclears 28, eosinophiles 10, lymphocytes 24, mononuclears 7; Meinicke test, negative.

Urine. — Acid, spec. grav. 1.020, albumin traces, few pus cells.

Stool. — Semi-liquid (after mag. sulph.), with undigested food particles and mucus; no blood; after careful search with high-power objective, eggs of *Clonorchis* were found, with typical lid and projecting brim.

The patient had fever for the first 2 days and was treated with quinine. When the malaria symptoms had subsided and the blood was free of parasites, a treatment with *tartar emetic* was started. Patient was given intravenous injections of 10 cc. of a 1% solution, at intervals of 1 to 2 days. He received altogether 0.8 grm. of tartar emetic, without any untoward effects.

After 3 weeks, the ascites had disappeared, the tenderness of the liver had subsided, and its size was reduced to normal. The stool still contained *Clonorchis* eggs, which could be found only by the concentration method of *Thelemann*. The patient felt much improved and was discharged with the advice to return two months later for another treatment with tartar emetic.

Clonorchis is a trematode, living in the bile-ducts and causing inflammatory and degenerative changes of the liver. Heavy infection sometimes leads to systemic disturbances with ascites and diarrhoea. The parasite is common in China and Japan and is transmitted by eating raw infected fish.

A CASE OF CONGENITAL APHACIA

H. R. Eichelbaum, M.D.

Almirante Hospital, Panama

In the past year (1926) a number of interesting eye diseases were met with in our hospital and dispensary clinics, among which syphilitic eye conditions, like iritis, keratitis, and retinitis, predominated. Among other conditions, gonorrhoeal conjunctivitis, trachoma, and senile cataract were not infrequently seen. One case of unusual interest was discovered accidentally, when admitted to the ward for treatment of gonorrhoeal epididymitis.

This case, H. B., colored, male, age 40 years, was affected with congenital aphacia of both eyes. Up to the present time, this congenital malformation has been only rarely reported and, according to de Schweinitz and Fuchs, is mostly combined with other faulty development of the anterior part of the eyeball. In this case, the malformation was recognized by means of the tremulous iris and the absence of anterior and posterior lenticular reflexes. The anterior chamber was very deep, and filled with fluctuating fluid.

The pupils, brown, did not dilate under the influence of atropin; nor did they react to light or distance.

The vitreous body showed numerous floating opacities and a general cloudiness; consequently the retina was not clearly visible, but appeared pigmented. Furthermore, external strabismus and nystagmus were present.

No history of a previous injury that might have caused dislocation and subsequent absorption of the lenses was given; the patient merely stated that his eyesight had been weak since birth. The bilateral aspect of the condition would alone suggest the improbability of any traumatic cause.

The vision was only one-tenth of normal, tested with Snellen's types, and was not correctible with any kind of lenses.

Therefore the eye condition was incurable, and the patient was discharged. He is occupied as a gardener, and has learned to handle the machete perfectly, to our great surprise.

SECTION IV

SYPHILIS IN THE TROPICS—WITH CASE REPORTS

O. T. Brosius, M.D., I. E. Peon, M.D., and H. R. Eichelbaum, M.D.
Almirante Hospital, Panama

It is not our intention to offer here an exhaustive treatise on the subject of syphilis, but merely to report some of our findings and experiences with this condition in the wards and the dispensary clinic of the Almirante Hospital.

The protean symptomatology in this disease varies in different races, as well as in different places. The disease is becoming gradually more protracted, most probably because the civilized races are constantly acquiring a greater immunity to the infection. There is little doubt but that the newer methods of treatment ameliorate, and sometimes obviate, its dreaded congenital tendencies.

In general, we note in the Tropics that certain manifestations of the symptom-complex predominate—such as the cardiac, cardio-vascular, bone, and periosteal lesions—while such manifestations as the para-syphilitic diseases (tabes and paresis) are extremely uncommon. Typical cases showing skin lesions of secondary syphilis are rarely seen in our clinics, while iritis, keratitis, pachymeningitis, and gummata occur not infrequently.

The three diseases of prime importance treated in the Almirante dispensary clinics, as well as in the hospital, are malaria, hookworm, and syphilis, and I believe that this holds true for most tropical countries in the western hemisphere. Since we have applied the Meinecke test for confirmation in all suspicious cases of syphilis, the incidence of this disease has been found to be high. We are now undertaking for all patients a routine Meinecke test, the results of which are expected to show a much higher luetic index than was previously supposed. For the year 1926 our hospital records show 690 cases of malaria, which represent 24.63 per cent of the admissions to the hospital; 105 cases of uncinariasis, representing 3.75 per cent of admissions; and 204 cases of syphilis, representing 7.28 per cent of all hospital case admissions. Many of these patients applied to the hospital for the treatment of symptoms not pointing directly to syphilitic infection and the disease was diagnosed from the routine physical examination and confirmed by the Meinecke test. Among those patients complaining of vague nerve and muscle pains, occurring most frequently in the lower spinal region, there was a high percentage of positive Meinecke tests.

Patients suffering from malaria, hookworm, and other chronic diseases, complicated by syphilis, do not respond readily to treatment unless the syphilis also is properly treated.

In last year's Annual Report of the United Fruit Company's Medical Department, one of us (H. R. E.) gave a detailed description of the Meinecke test as it is performed in this hospital, and with it the technique for doing a microscopic modification of the test. Herewith (Fig. 1, below) we are submitting a microphotograph of the Meinecke test, illustrating graphically the appreciable difference in appearance between the positive and the negative findings by this modification.

During 1926, 1,449 Meinecke tests were made in this hospital. Of these, 863 were negative, and 586 positive.

Recently we have been running a parallel series of comparative Meinecke and Kahn tests, the technique for the latter having been the same as that used and recommended by the Medical Department of the U. S. Navy. In these two series of 331 tests on the same sera, the Meinecke was positive in 111 cases, and the Kahn in 104 cases. In only about 5 per cent of this series, then, was there any difference in the results indicated by these two tests. This small series shows, in detail, that 6 sera which were positive for the Kahn were negative for the Meinecke, and 11 sera which were positive for the Meinecke were negative for the Kahn; 314 tests agreed absolutely. Our Wassermann checks of these two series are too few to be used in this comparative analysis.

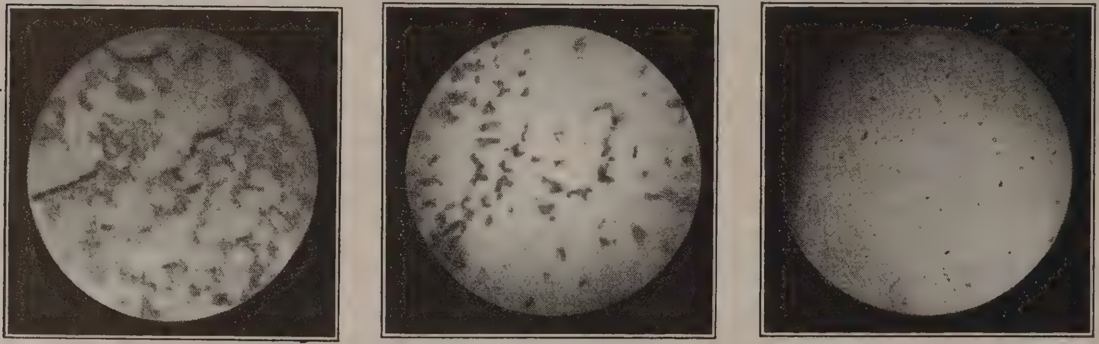


FIG. 1

Notwithstanding the intensive use of all the methods of luetic therapy—the mercurial and arsenical preparations (including stovarsol) and the iodides, bismuth compounds, and their various combinations—we occasionally find cases that are strangely resistant to all forms of these therapeutic agents. In this category, according to our experience, we have found the eye cases to be peculiarly resistant. The following are examples:

Case No. 1. — Mr. P., Panamanian, male, age 40, very well developed and well nourished, of good habits, and always in excellent health previously. His family history, as well as his past history, was negative, and apparently his primary lesion was almost negligible. The first manifestation of his disease came in March, 1924, immediately after he had been bathing in the ocean, having swum under water with his eyes open. Noticing a peculiar burning sensation in his left eye, accompanied by blurred vision, he applied to the hospital for diagnosis and treatment. The case was diagnosed as iritis, and his Wassermann test was positive.

Between April 24 and May 13, 1924, neosalvarsan was administered intravenously, once a week, as follows: 0.45, 0.6, 0.75, and 0.9 gram. After this, he was given sodium iodide and protoiodide of mercury. During this time the eye condition grew gradually worse: The tension became increased, as did the general inflammatory condition; choroiditis set in, with floating bodies in the vitreous; and all this was followed by the development of a severe interstitial keratitis. The other eye became similarly involved. Intramuscular injections of bismuth were then begun, and were continued throughout the year, alternating with mercury ointment inunctions and intramuscular injections of the salicylate of mercury up to the point of salivation.

During the year 1925 the foregoing treatment was continued, and 7 more injections of neosalvarsan, 0.75 and 0.9 gram each, were given intravenously. The Meinecke test was still +++ positive in October and December of that year. The symptoms had not abated much, and vision gradually grew dimmer, opacities developed in the lens, chiefly of the right side, and a leukoma appeared on the same side as the keratitis.

In January, 1926, stovarsol was tried, because of recommendations for this condition by certain German authorities, but there was no apparent improvement. In January and February, 6 more intravenous injections of neosalvarsan, 0.75 and 0.9 gram each, were given, together with iodides and mercury, but still the condition seemed to remain at a standstill.

During the month of March, it was decided that we should have to give something to cause a febrile reaction. A milk injection was first tried, without any result. Subsequently, once each week for 4 consecutive weeks, an intravenous injection of 2 minims of typhoid vaccine was given, which on each occasion gave rise to a chill followed by fever, and on the following day 0.9 gram of neosalvarsan was given intravenously. At the end of the 3rd injection the Meinecke test was still positive ++ . At this time, in consultation with Dr. Reeder of the Herrick Clinic, Panama, R. P., we decided to give weekly intravenous injections of flumerin, for 12 consecutive weeks. Potassium and sodium iodide were again repeated, and altogether 6 more intravenous neosalvarsan injections, 0.9 gram each, were administered, alternating with the flumerin.

The Meinicke test remained positive ++, but the inflammatory condition in both eyes had practically subsided.

In August, 1926, the Meinecke test still showed a ++ positive reaction, and 2 injections of intramuscular mercury salicylate were given, 5 days apart. At the end of this month the patient was sent to Dr. Reeder, at the Panama Hospital, for extraction of the right lens, which by this time had become quite opaque. The left eye (the one which had been affected primarily) had almost entirely recovered. The Wassermann test performed by the Ancon Hospital Board of Health laboratory at this time showed +—. While the patient was at the Panama Hospital, intramuscular injections, every 5 days, of bismuth salicylate were begun, and the series of 12 doses was concluded here at the Almirante Hospital. Dr. Reeder's report showed that the extracted lens was very soft, and left behind a thickened capsule, which will have to be extracted later.

The Meinecke test, which seems a little more delicate than the Wassermann, was + but the Kahn was negative, in November. Again, 2 injections of mercury salicylate and 2 more of 0.9 gram of neosalvarsan were given, supplemented by 2 injections of salvarsan combined with metaphen. At the end of December, the Meinecke test was + positive.

At the time of writing, the vision in the left eye continues to improve, and the patient is still taking increasing doses of potassium iodide.

Case No. 2. — B. C., negro, female, age 22, well developed and well nourished. Any past history of importance was denied. She had applied to the dispensary clinic for treatment for a tumor, apparently of the iris of the right eye, and because of an accompanying interstitial keratitis of the same eye, syphilis was suspected. The eye-ball protruded; tension was greatly increased, and was accompanied by excruciating pain with photo-phobia, lachrymation, and impaired vision. The fundus was not visible, because of opacities in the vitreous. The Meinecke test was +++ positive and the tumor of the iris was diagnosed as of syphilitic origin.

In addition to local treatment, such as cold applications and yellow oxide of mercury ointment, she was given 4 weekly intravenous injections of neosalvarsan (doses 0.45 gram each) in conjunction with mercury ointment inunctions and mixed treatment by mouth. Up to this time, unfortunately, there continued to be an increase in the severity of the symptoms and signs. Weekly intravenous injections of neosalvarsan, 0.6 gram, mixed with metaphen were then begun. After the 3rd injection, the Meinecke test was still positive +++, but the patient showed considerable improvement.

To date, she has had 5 injections of this combined treatment, and all symptoms and signs have completely disappeared, with a return of normal vision.

Other cases which may be of interest, because they present unusual features, are given below:

Case No. 3. — *A Panamanian boy*, age 12 years, was admitted to the hospital April 21, 1926, suffering from suppurating ulcers on the right shoulder and right leg.

Family History. — His father is dead; cause unknown. His mother is living, and well. He has also two brothers, who are well.

Mother's Married History. — 3 living children, and 3 abortions.

Patient's History. — Illness dates from April, 1925, when swelling started over right shoulder and in right ankle joint. These swellings were very painful, and after 4 months broke down, and considerable pus exuded, after which the pain was relieved but the discharge continued, and other swellings formed higher up on the right leg and at the right claviculo-sternal joint, which also broke down.

Physical Examination. — A well-developed, poorly nourished, and markedly anaemic colored boy—showed a coated tongue, and a marked glandular adenopathy. Both ends of the right clavicle were protruding from the ulcerations, and with forceps the entire necrotic clavicle was completely removed, without difficulty.

The heart sounds were somewhat weak, and a faint haemic murmur was heard at the base, systolic in rhythm. The spleen was markedly enlarged and hard, and the liver extended 2 finger-breadths below the costal border. The right leg was red and swollen, and 3 sinuses discharging pus were present.

Laboratory Reports. — *Urine:* Negative. *Stools:* Uncinaria, ascaris, and trichocephalus. *Blood:* Negative for malaria; haemoglobin, 50 per cent. *Meinecke reaction:* Strongly positive. *X-ray examination* revealed an osteomyelitis of the first rib, right tibia, and fibula.

Treatment. — The entire first rib was removed; 80 per cent of the tibia was curetted out of the periosteum, as well as about 50 per cent of the fibula. The medical treatment consisted of a nourishing diet, several courses of chenopodium to remove the intestinal parasites, and anti-luetic treatment which consisted of iodides, bismuth, and "914."

Two months after the patient's admission, the haemoglobin had dropped to 35 per cent, the blood was still strongly positive, and a swelling started in the right gluteal region. On incision, much pus was removed, as well as a large piece of the ileum, which had already formed a sequestrum. The administration

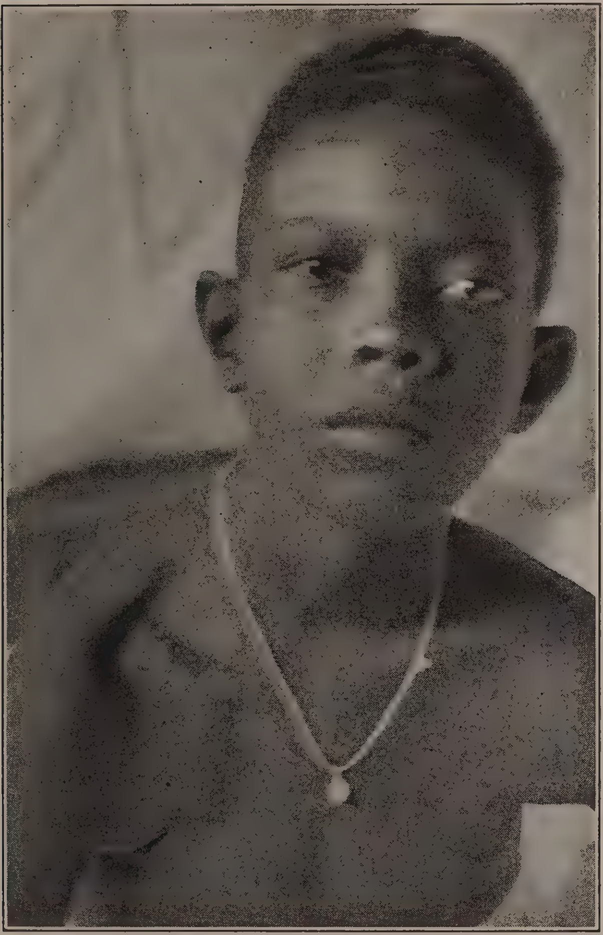


FIG. 2
Case No. 3, at discharge, showing clavicular region

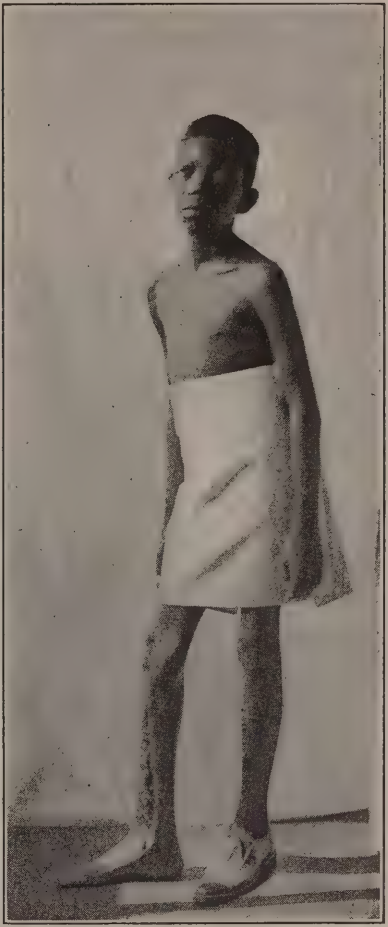


FIG. 3
Case No. 3, at discharge, showing condition of right leg

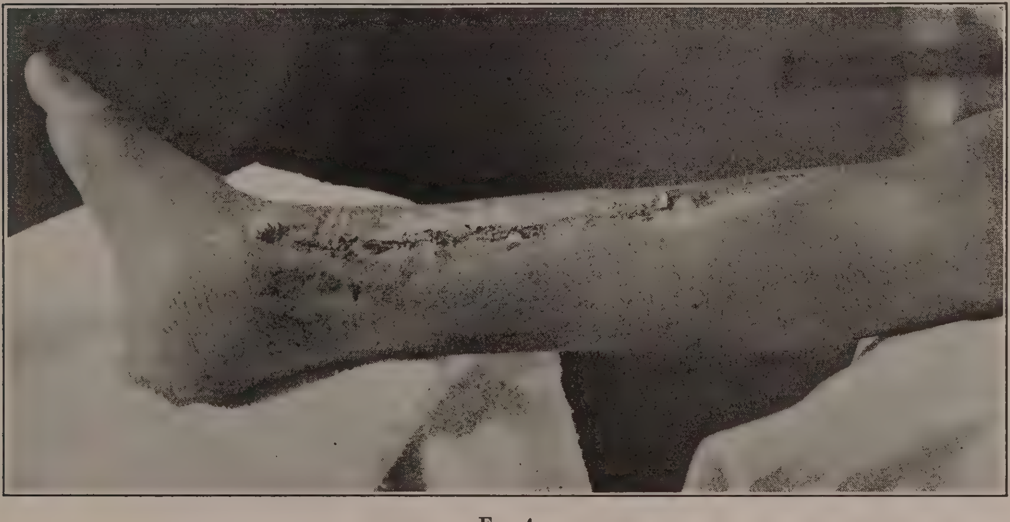


FIG. 4
Case No. 3, at discharge, showing close-up view of right leg

of preparations of iron, arsenic, mercury, and iodides was continued, and 4 months after admission the Meinecke reaction was at last negative and the haemoglobin had increased to 50 per cent.

The boy was discharged from the hospital in September, 1926. The clavicle and first rib are entirely absent, but this seems not to inconvenience him seriously, as he has almost perfect use of the arm. The bone tissues of the tibia and fibula have regenerated and he has perfect use of the leg.

The accompanying photographs (p. 153) illustrate the case.

Case No. 4. — Young negro, female, age 16. Her mother stated that she had always been weak and sickly since birth, that she had had fever frequently, and had always been very anaemic. She had never menstruated. In her present illness she had been suffering from fever and extreme weakness for 5 days. On admission, her temperature was 105° F., pulse rate 144, and respirations were 56 to the minute. She complained of headache, and pains distributed generally over the entire body. The tongue was pale and coated, and the anaemia pronounced. There was a slight rigidity of the neck, but no positive Kernig's sign. Both tibiae were bowed, and there was a general glandular enlargement. The heart and lungs were negative; the liver and spleen could not be palpated.

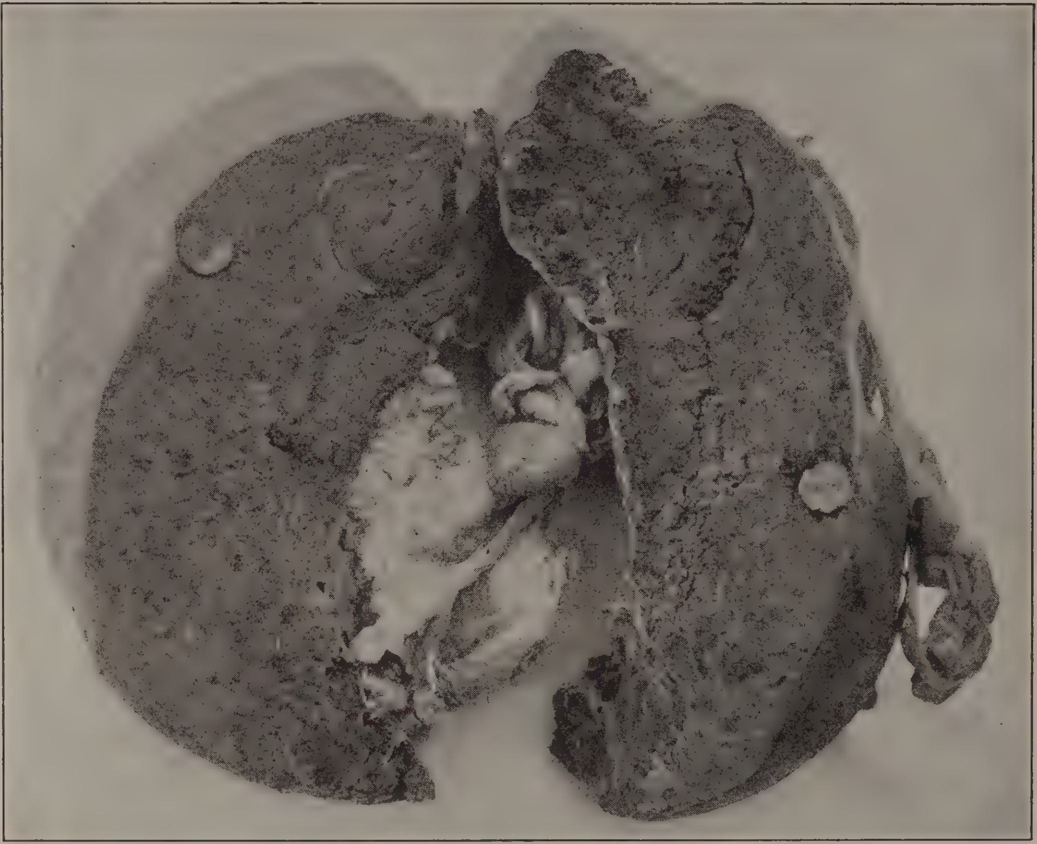


FIG. 5
Case No. 4, showing spleen with gummata

The patient lapsed into subconsciousness shortly after admission and could not talk; she swallowed some food and medicine but soon became totally unconscious, and died the following day.

Laboratory Reports. — *Urine:* Specific gravity, 1.011; trace of albumin; negative for sugar; sediment showed hyaline and granular casts, and a few pus cells. *Stools:* Negative. *Blood:* Haemoglobin, 25 per cent; W. B. C. 29,000; Differential W. B. C.: polymorphoneutrophiles 46 per cent; large mononuclears 10 per cent; small lymphocytes 32 per cent; transitional cells 7 per cent; myelocytes 4 per cent; mast cells 1 per cent; Widal test, negative.

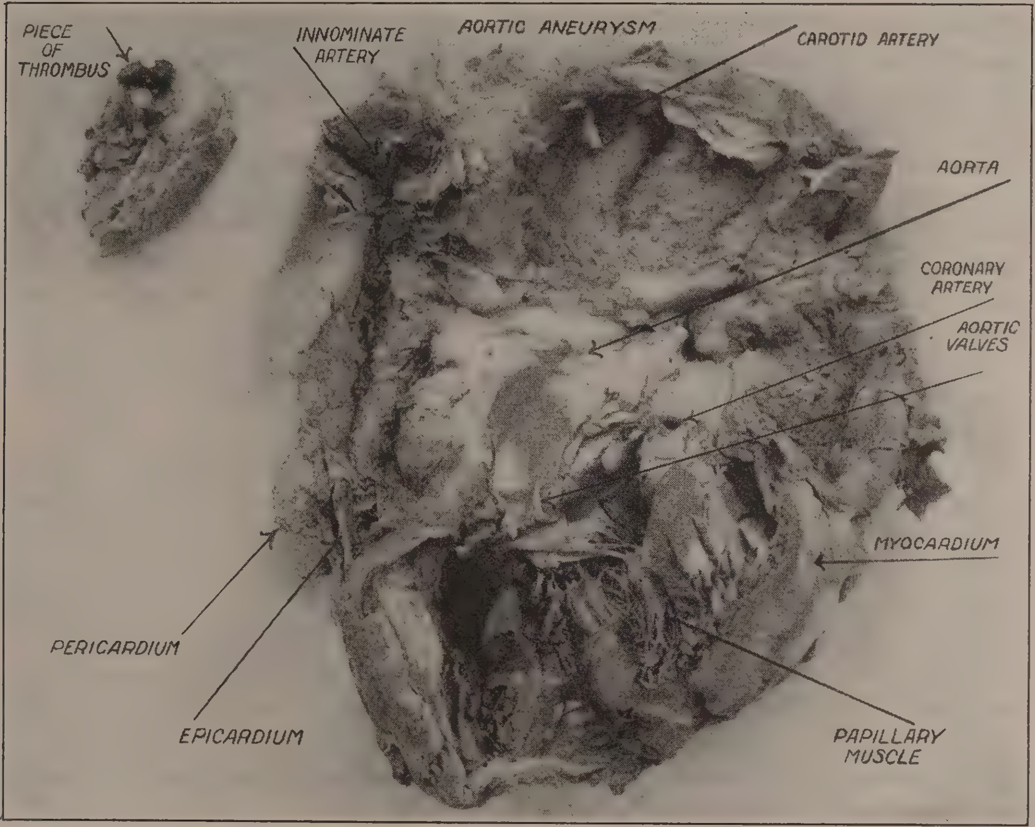


FIG. 6
Case No. 5, showing heart, aorta, and associated lesions

Briefly stated, the striking feature at autopsy, besides the luetic liver and other syphilitic manifestations, was the nodular, contracted spleen, presenting miliary gummata—rather an uncommon finding in a patient of this age. (See accompanying photograph, p. 154.)

Case No. 5 (see photograph, above) is from the autopsy finding in a negro woman, age 23, who died in coma shortly after admission.

The heart was small and of normal musculature, except for a slight degree of brown atrophy. The ascending aorta was dilated to 3 times the size of the heart, exhibiting an aneurysm which had perforated into the pericardial sac. The aortic intima was ulcerated and covered with large, partially organized, thrombotic masses. Two colliquation cysts were also found in the cerebrum, and one in the medulla oblongata.

SYPHILIS AND FRAMBOESIA AMONG HAITIAN LABORERS IN CUBA, WITH TEN ILLUSTRATIONS

WILHELM CORDES, M.D.

Preston Hospital, Cuba

Until this year, no case of framboesia (yaws) was recognized or recorded in the Preston Division. In the 1926 Annual Report, 30 cases appear under this heading as the primary diagnosis in the classification of diseases treated in the hospital. In 48 other patients, framboesia was cited as a secondary diagnosis. All these cases were black male Haitians, who came over to Cuba as cane-cutters. There had already been observed among these laborers many symptoms which could more or less be attributed to late or tertiary syphilis, and which were recorded as such. Special attention was paid to the differential diagnosis only after Dr. H. C. Clark, during a visit to this division, had pointed to the possibility of some of these conditions being late manifestations of framboesia.

This disease is practically unknown in Cuba. The writer, in three years' experience, has never seen a case of primary or secondary framboesia, with the characteristic skin eruptions.

On the other hand, the island of Haiti, and especially its western part with its predominant colored population, during historic times has been a focus of framboesia. Experienced medical observers in Haiti state that practically the whole rural population is infected with it. Butler[1] estimates that 80 per cent of the Haitian population suffer from treponematosis. Wilson[2] saw in the Jacmel District, within 9 months, 1,100 cases of early, and 4,000 of late, framboesia. The superficial observer easily overlooks its presence, because in Haiti it is regarded as a disease of shame. Sick people with manifest signs hide away like lepers, and are not allowed to enter the towns and market places. One has to go to the rural districts usually in order to see cases with fresh eruptions. Wilson[3] also describes tubercular framboesids, periostitis, sabre-shaped tibia, gangosa, and keratosis plantaris ("crab yaws"), as manifestations of tertiary framboesia, and he is prepared for the suggestion that many of these clinical manifestations are also caused by syphilis. True syphilis undoubtedly exists in Haiti, but it seems to be largely limited to the town population, and its course probably does not differ from syphilis as observed elsewhere.

During the months from August to December, 1926, all Haitians admitted to this hospital were subjected to a special examination for syphilis and framboesia. The survey was made from three points of view: (a) history, (b) serum reaction, and (c) clinical manifestations. Out of this series of 156 men, 42 were free of symptoms, the rest, 114, or 73.1 per cent, presented more or less definite signs of late syphilis or framboesia.

Emphasis was laid on the importance of individual history. The Haitians are rather reliable in their statements concerning external diseases. Like most primitive people, they observe well and distinguish between the skin eruptions of smallpox, measles, scabies, and other diseases. Framboesia is called "pian" in Haitian patois; the primary lesion has the impressive name of "maman pian." Every Haitian knows what "pian" is; and if he has had it, he will readily show the spot on his body where the "maman pian" was located. Sometimes, the Haitians, for reasons above mentioned, will deny having had the disease, and will admit it only when suspicious scars are demonstrated to them. Others, when asked: Have you had "pian"? may answer indignantly: "No, I am from town." It has not entered their minds that late manifestations, like leg ulcers and "crab feet," have some relation to previous framboesia, which is regarded by them as an exanthema of infancy.

Of our 156 patients, 79, or 50.6 per cent, gave a history of framboesia, generally contracted during childhood; 65 of them could still show on their bodies evidence of having had "maman pian," which was for the most part discernible as soft, flat scars ranging from the size of a ten-cent piece to that of a dollar. The sites of the primary framboesoid lesions were as follows:—

Location	No. of Cases
Foot and ankle region	48
Other parts of the leg	9
Hand and fingers	4
Scrotum	1
Axillar region	1
Upper lip	1
Forehead	1

The predilection of the infection for the lower extremities is agreed upon by all observers. This is explained by the fact that bare feet are more frequently the site of the skin lesions because exposed, and thus in direct contact with infected material.

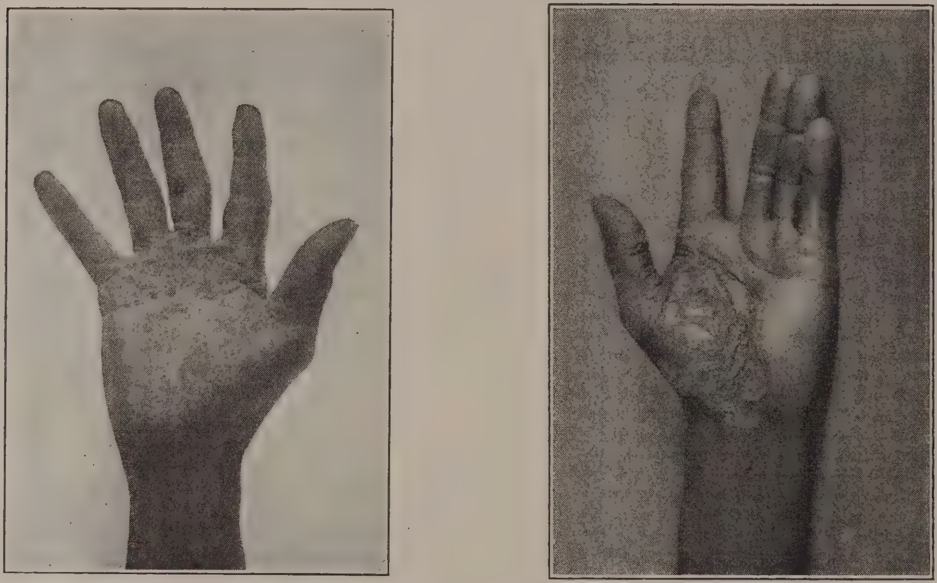
In strong contrast to accurate yaws history data given by these men, a clear history of syphilis was given by only one man (from the city of Port au Prince) who had contracted a chancre when he was a soldier. Another man, who had a maculo-papular skin eruption, recalled having had a lesion on the penis 5 years previously, but, on examination, no scar could be found.

Most of our patients were young men who were not more than 18 years of age, and yet many showed tertiary symptoms. It is improbable that these youths are genital tertiary syphilitics.

With the exception of 7, the blood serum of all patients was examined by the turbidity test of *Meinicke* (Meinicke Truebungs-Reaktion or M.T.R., which is a modified precipitation test). Of 149 sera examined, 93, or 62.4 per cent, gave a positive reaction, the majority being +++. Only 8 cases with a positive history of framboesia gave a negative serum reaction. In all the other cases, a positive history was accompanied by a positive serum test.

Dickens[4] reports that 60 per cent of Haitians give a positive reaction to the Wassermann test.

These figures are strikingly high, even if one considers that they are gained from hospital cases; they can be explained only on the supposition that, besides syphilis, there is present another disease which gives a positive serum reaction. One would not expect syphilis in its ordinary course to show such a high rate of infection, even in a population that has little or no restraint in sexual habits. Day and McNitt[5] found 30 per cent of their colored patients in the Southern States positive for the Wassermann test. Clark[6] reports that serological tests for syphilis among Central American negroes were positive in 35 per cent.



NOS. 1 AND 2

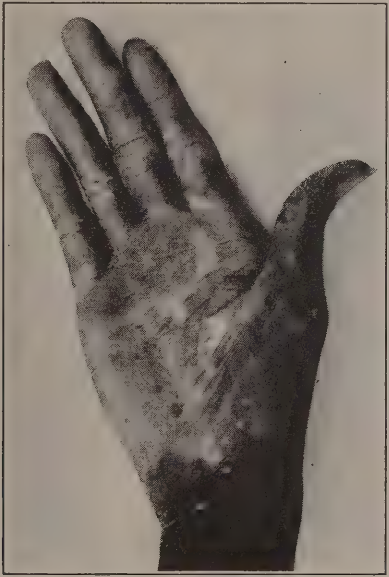
Unfortunately, at present it is impossible to differentiate syphilis and framboesia by means of the Wassermann or any other serological test. From clinical evidence, however, it seems that most of the positive serum reactions in Haitians must be attributed to framboesia.

The clinical symptoms in our cases are recorded irrespective of the disease to which they belong.

Enlarged superficial lymphatic glands are extremely common in colored laborers, and cannot be considered as having much specific bearing in the diagnosis of syphilis. Of our patients, 112 showed definite glandular enlargements—many being without any other clinical evidence of syphilis. Inguinal adenitis is frequently encountered and, no doubt, is often caused by non-venereal infections of the lower extremities or genital regions. Enlarged epitrochlear glands are, perhaps, of more diagnostic value. They were found in 66 cases, practically all of which gave a positive history and positive serum reaction.

Small scars and local irregularities in the pigmentation of the skin have little diagnostic value. In 7 cases, however, extensive cicatricial skin lesions were found, with irregular outlines, and with or without retraction, sometimes covering half or more of an extremity or large parts of the trunk (Illustrations Nos. 4 and 5). These were probably the result of chronic creeping papulo-tubercular eruptions or superficial gummatous lesions.

Another clinical feature encountered is an atrophic skin change of the palms of the hands and soles of the feet, with irregular areas of depigmentation, resulting in a marmoriform appearance (Illustration No. 3). It was seen in 4 cases, all of whom were old men. This dystrophy seems identical with "melung" (Castellani, and others)[7] and may have some relation to palmar and plantar keratosis, although two of the patients stated that they had suffered a long time from "crab" (crab yaws).



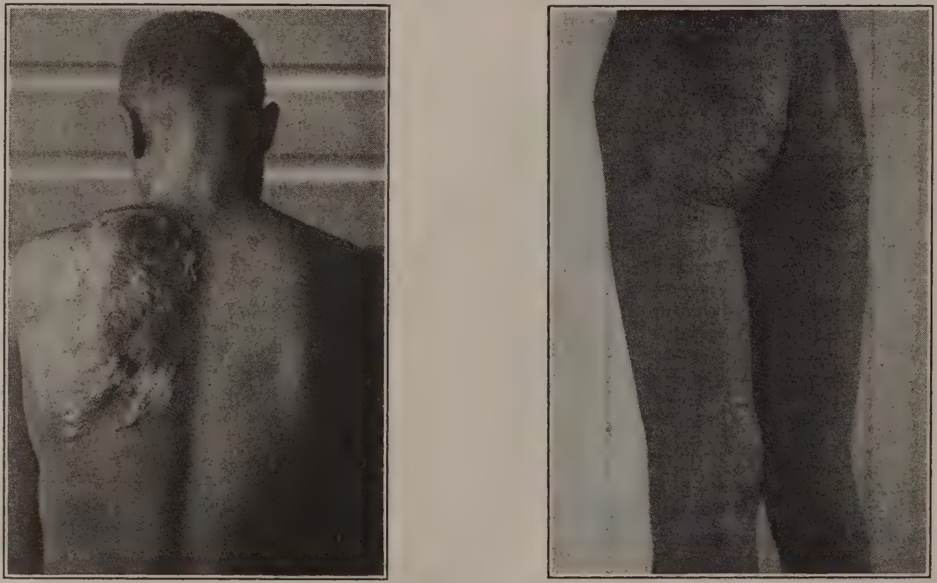
No. 3

Relatively common among Haitians are extensive scars resulting from partial or complete destruction of the glans and shaft of the penis (3 of our cases). These mutilations are sometimes hard to explain. In the acute stages, the process may have a condylomatous or gummatous character.

We recorded the following active skin lesions:

No. of Cases	Nature of Lesion
1	Diffuse maculo-papular eruption
5	Condylomatous eruption in the genital and anal regions
7	Keratosis plantaris ("crab feet," which the Haitians also call "pied crab")
3	Keratosis palmaris (see Illustrations Nos. 1 and 2)
1	Keratosis pilaris (see Illustration No. 8)
4	Nodular or papulo-pustular skin lesion (serpiginous framboesid [see Illustrations Nos. 4, 5, 6, and 7])
12	Leg or foot ulceration

Leg ulcers may be divided into three groups: (1) Multiple, superficial skin lesions more or less pustular in character (2 cases). (2) The common type (7 cases) is the deep, round, dirty ulcer with overhanging edges. They are also multiple, and may represent a gummatous condition of the skin or subcutaneous tissue, which is broken down and infected secondarily with spirochaetes and fusiform bacilli. (3) Ulcers contiguous to and adherent in, periosteal or bone changes (3 cases).



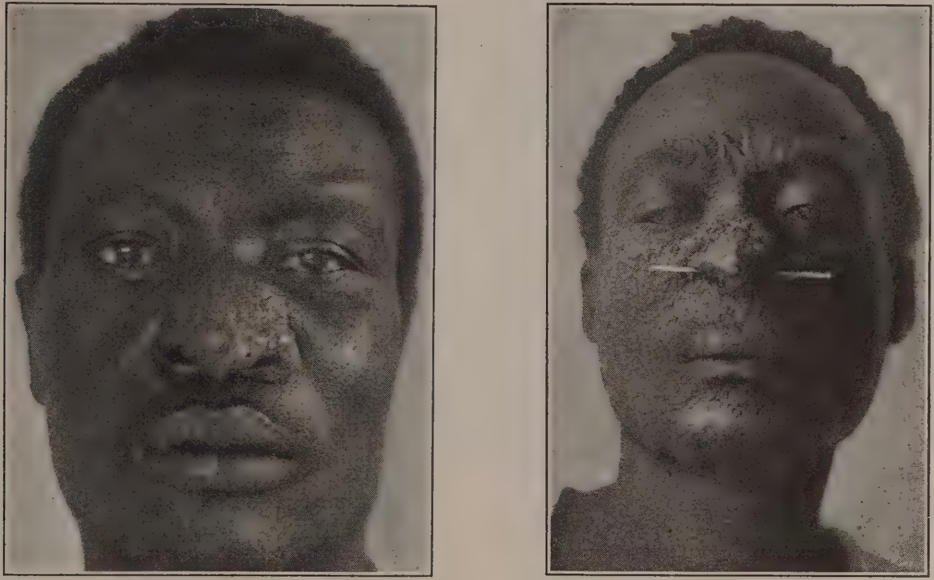
NOS. 4 AND 5

Lesions of the mucous membranes are comparatively rare. We recorded 1 case of specific angina, 2 cases of destructive ulceration of the soft palate, 1 case of perforated septum, and 1 case of "saddle nose."

Fully developed rhinopharyngitis mutilans, or gangosa, which is frequently encountered in Haiti, is not seen in Cuba. People with this ugly disfigurement do not emigrate; and probably for the same reason, also, other extreme destructive stages of tertiary syphilis or framboesia are rarely encountered in our patients.

Juxta-articular nodules of the elbow and trochanteric region were observed in 3 cases.

Bone and periosteal lesions were common in our patients. There are on record 32 cases of periostitic changes of the tibia (thickening of the bone, exostosis, sabre-shaped tibia). Of these, 3 were in an acute stage, with heat, tenderness, oedema of the skin, and pains which were more severe at night. Periostitis was often associated with osteitis of a proliferative or gummatous character. We saw 1 case of diffuse osteitis of the femur (see Illustration No. 10), 1 case of osteitis of the clavicle, and 2 cases of chronic osteomyelitic dactylitis. One patient showed a periosteal swelling on both sides of the nose, a condition resembling "gundu," which is rarely encountered in Haiti (personal communication of Dr. P. W. Wilson).



NOS. 6 AND 7

We observed 4 cases of arthritis, with swelling and tenderness of knee and ankle joints, sometimes with slight effusion. These gave a positive serum reaction and yielded quickly to specific treatment; 5 cases complained of "rheumatic" pains in the bones and joints, without external evidence of inflammation.

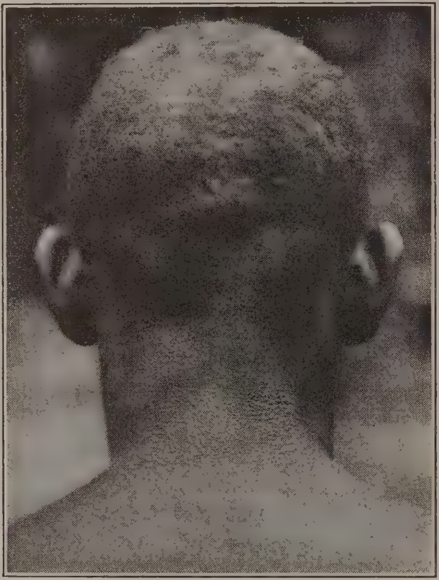
It was noticed that tibial periostitis and ulcerations were often on the same leg, and near the scar shown by the patient as "maman pian."

A common finding was chronic orchitis and hydrocele (11 cases, 9 of which gave a positive serum test).

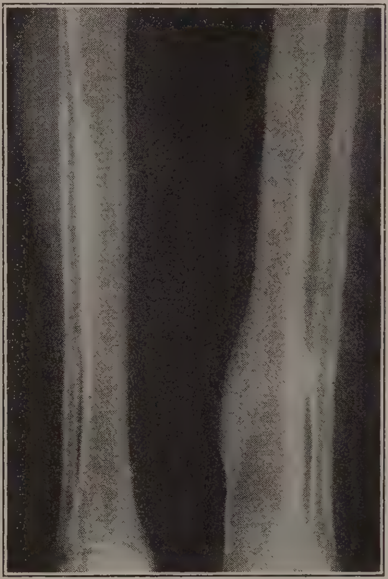
Iridocyclitis, evidently of specific origin, occurred twice.

We saw 1 case of aortitis and beginning aneurysm of the ascending aorta with valvular heart lesions (autopsy), and 1 case of advanced ataxia with lancinating pains in the legs, but without eye signs.

Which of the enumerated manifestations are of syphilitic origin, and which are due to framboesia? Some lesions of the vascular and nervous systems are most probably caused by syphilis; others, especially certain skin lesions, are found only in framboesia-infected populations. Bittner[8] reports from Java that the following triad of symptoms is typical of tertiary framboesia: rhinopharyngitis mutilans, *keratoma plantare sulcatum*, and juxta-articular nodules. Gutierrez[9] describes the same manifestations in the Philippine Islands. We would add, as a fourth pathognomonic condition for late framboesia, the serpiginous pustulo-nodular dermatitis, resulting in extensive scars (Illustrations Nos. 4, 5, 6, and 7).



No. 8



No. 9
Periostitis associated with osteitis of proliferative or gummatous character

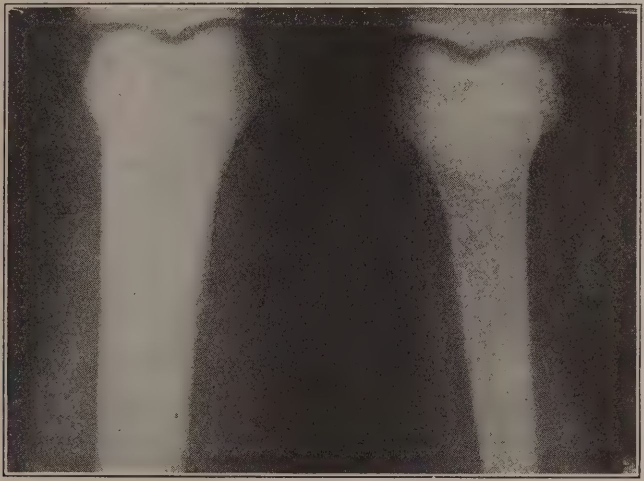
Between those two extremes, however, manifestations characterized by ulcerations, gummatous changes, bone and periosteal and other lesions, are encountered, which undoubtedly belong to both syphilis and yaws, and render differentiation extremely difficult, if not impossible.

The history may sometimes help to clear up the situation. Tertiary symptoms appearing in young people under 20 years of age who have had framboesia during childhood should not be considered as of syphilitic origin.

The absence of primary venereal lesions and the rarity of secondary syphilitic eruption are remarkable, in view of the facts that the ages of most of the men were between 18 and 35, and that they were exposed to infection by their promiscuous sexual habits. There seems to be no doubt that true syphilis in framboesia-infected people is extremely rare. Harper[10] was unable to find primary syphilis in the population of Fiji, which suffers heavily from framboesia. Butler and Peterson[11] also point out that genital chancres are very rare among Haitians, especially those who have had framboesia. In thousands of individuals who gave histories of having had framboesia, only 3 were reported as having had apparently primary genital syphilitic sores. Peterson and Butler see evidence that framboesia protects against subsequent genital infection with syphilis.

The question of cross-immunity between syphilis and framboesia is open to discussion. Even if such a mutual protection existed, the knowledge would be of little or no service in the differentiation of some of the tertiary lesions that are seen in both diseases.

This same difficulty seems to prevail in other tropical countries, where a native population with endemic framboesia comes in contact with cosmopolitan syphilis.



No. 10

Statistical reports from these countries may be misleading, inasmuch as the observers incline to a diagnosis of syphilis or framboesia. For instance, Harper denies the presence of syphilis among Fijians, and goes so far as to attribute aneurysm, tabes, and even general paralysis of the insane to framboesia. On the other hand, Nogue's[12] report on syphilis among natives of Senegal tends rather to the exclusion of framboesia, of which he found only 4 cases in 4 years. He also states that primary chancres are but seldom seen, that the disease is often acquired in childhood, and that juxta-articular nodules and tuberculo-ulcerative skin lesions are common. His entire percentage of positive serum tests was 52.77. Such data rather point to the probability that in Fiji and in West Africa framboesia and syphilis coexist, as they do in Haiti.

Butler and Peterson [11] in Haiti use the term *treponematosis*, and are of the opinion that both diseases are identical—that framboesia is nothing but native syphilis, acquired in childhood, extragenitally, and modified by racial and climatic influences. There are certainly many arguments to support this contention, but which need not be repeated here. With our present incomplete knowledge of cross-immunization, however, and the varied biological characteristics of the different strains of treponema, one must, for differential diagnosis, still cling to the traditional distinction, based on clinical signs in the early stages.

The word *treponematosis* need not imply that both diseases are identical, but it is a very useful term whereby to accentuate the similarity of the clinical manifestations of the two diseases as they are seen in Haiti, and to obviate an erroneous classification of the late manifestations when a differential clinical diagnosis is often impossible.

REFERENCES

1. Butler, "Medical Needs of Haiti," *U. S. Nav. Med. Bull.*, Vol. xxiv, No. 2, 1926
2. Wilson, "Observations Concerning Yaws in Haiti," *U. S. Nav. Med. Bull.*, Vol. xx, No. 2, 1924
3. Wilson, Discussion in *Proceedings of the International Conference on Health Problems in Tropical America*, United Fruit Company, 1924, (p. 586)
4. Dickens, "A Two Years' Study of Dysentery in Haiti," *U. S. Nav. Med. Bull.*, Vol. xxiii, No. 6, 1925
5. Day and McNitt, Cited in Stitt's "Practical Bacteriology"
6. Clark, "A Survey at Tela Hospital to Determine Syphilis," United Fruit Company Medical Department. Annual Report, 1923
7. Castellani, "Manual of Tropical Medicine," William Wood and Co., 3rd Edition, (p. 2,222)
8. Bittner, "Some Observations on the Tertiary Lesions of Framboesia Tropica, or Yaws," *Am. Journ. Trop. Med.*, Vol. vi, No. 2, 1926
9. Gutierrez, "Late or Tertiary Manifestations of Yaws," *Arch. Dermat. and Syph.*, Vol. xii, No. 4, 1925
10. Harper, "Yaws in Fiji," *Kenya Med. Journ.*, Vol. ii, No. 1, 1925; reviewed in *Trop. Dis. Bull.*, Vol. xxii, No. 552
11. Butler and Peterson, Personal Communication
12. Nogue, "La Syphilis chez les Indigenes du Senegal." "La lutte contre la Syphilis a Dakar." *Ann. d'Hyg. Publique, Industrielle et Sociale*, New Ser., No. 3, 1924; reviewed in *Trop. Dis. Bull.*, Vol. xxi, No. 799

TREATMENT OF ACUTE GONORRHOEAL EPIDIDYMITIS BY INTRAVENOUS INJECTION OF SODIUM IODIDE

W. A. HUTCHINSON, M.D.

Truxillo Railroad Company Hospital, Puerto Castilla, Honduras

Some months ago we began the use of intravenous sodium iodide in cases of epididymitis, with the object of finding some reliable treatment other than operation which would give the patient quick relief from pain and shorten the period of hospitalization. While operative procedures for suppuration are still considered the quickest and most effective method of relieving pain, the following treatment has proved very successful in our hands.

Treatment. — The patient is put to bed, with a suspensory bandage to support the testicles, and ice caps are applied constantly to the affected part. He is given a diuretic mixture to alkalinize the urine and lessen pain on urination. Then he is given 31 grains of sodium iodide, intravenously. On the 3rd day this dose is repeated. Although some cases ceased to complain of any pain and were able to walk with perfect comfort after the 2nd treatment, a 3rd dose was given in most instances. One of these cases is still under treatment for prostatitis, and he has had no further symptoms from the epididymis. Another case is still under treatment, for severe iodism as evidenced by skin eruption; it may be interesting to note that this is the only case in which this symptom was noted, and he was the only white man in the series.

CASE REPORTS

Case, G. N., Nicaraguan, male, age 24 years.

History. — Gonorrhoeal urethritis, with pain and burning on urination, for the past month. About 3 days ago, he first noticed swelling and pain in the right testicle, which has become more acutely painful today.

Physical Examination. — Scars in both inguinal regions, from old inguinal adenitis. Inguinal and epitrochlear glands enlarged. Spleen tip palpable. Free pus in urethra. Right testicle swollen and painful, right epididymis hard and extremely painful to the touch.

Laboratory Reports. — *Urine:* Albumin trace, Pus ++
Blood: Negative for malaria parasites
Stools: Trichocephalus dispar
Smears from Urethra: Positive for gonococci.

Treatment. — The patient was put to bed with an ice cap on the testicles, which were supported by a suspensory bandage. Codeine was given to control intense pain. Urotropin gr. xv was administered 3 times a day. On the 2nd day he was given sodium iodide gr. xxxi, intravenously, which was repeated every 2nd day, for 3 doses. After the last injection, the pain disappeared, and on the 8th day he was able to walk around without discomfort. At end of the 16th day he was discharged, with no further symptoms of the disease.

Case, C. M., Honduranean, male, age 24 years.

History. — Gonorrhoeal urethritis for past 2 months. Three days ago, he first noticed pain in the left testicle; this became acute in a few hours, and the patient stated that he had been unable to sleep for 2 nights.

Physical Examination. — Spleen enlarged, extending down to the level of the umbilicus. Slight purulent discharge from urethra. Left testicle somewhat enlarged. Left epididymis enlarged, indurated, and acutely painful on pressure.

Laboratory Reports. — *Urine:* Albumin trace, Pus +++, Epith. cells
Blood: Negative for malaria
Stools: Ancylostoma
Smears from Urethra: Positive for gonococci

Treatment. — Ice bag and suspensory bandage were applied to the testicles, and the patient was put to bed. On the following morning he was given sodium iodide gr. xxxi, intravenously, and an alkaline diuretic mixture was prescribed. The following day the patient had very little pain. On the 3rd day he had a severe chill, with temperature 104.6° F., which subsided within 24 hours after the administration of quinine gr. xx b.i.d. He suffered no more pain from the epididymis, but was given a 2nd dose of sodium iodide on the 9th day, and was discharged on the 12th day as cured.

Case, B. G., Jamaican, male, age 38 years.

History. — Pain and burning on urination, beginning about 10 days before admission to hospital. Purulent urethral discharge for past 9 days. Pain in left testicle during past 24 hours, which has become very acute and accompanied by some swelling. He has noticed that immediately following urination 1 or 2 drops of blood are passed. No urethral injections have been given.

Physical Examination. — A well-developed and well-nourished negro, manifestly in acute pain. There was purulent discharge from the urethra. The left epididymis was swollen, indurated, and acutely painful to the touch.

Laboratory Reports. — *Urine:* Trace of albumin, many pus cells
Blood: Negative for malaria parasites in thick and thin films
Stools: Ascaris and Trichocephalus dispar
Smears from Urethra: Positive for gonococci

Treatment. — The patient was put to bed with a suspensory bandage and an ice bag on the testicle. An injection of sodium iodide, 1 ampoule containing gr. XXXI, was given on the morning of admission; also an alkaline diuretic mixture 3 times a day. That night the patient stated that he felt much relief. The following day the pain was less but still present. On the 3rd day, he was given a 2nd injection of sodium iodide. Although the pain was still present, the patient was able to sleep. He was free from pain on the 4th day. A 3rd injection was given on the 5th day. Two days after the 3rd injection, he was given chenopodium treatment for ascaris. After being treated for posterior urethritis for 6 days longer, he was discharged from the hospital. The epididymis was slightly enlarged, but there was no tenderness and the use of the suspensory had been discontinued 5 days prior to date of discharge.

Case, E. F., white, Jamaican, male, age 28 years.

History. — Gonorrhoeal urethritis for 3 weeks. He had used self-prescribed injections for a week before seeing a doctor. A few drops of blood were noticed at the end of urination, and there was considerable pain on defecation.

Physical Examination. — Prostate enormously swollen and tender, especially the right lobe. Right testicle slightly swollen, and right epididymis very tender. A purulent urethral discharge was present. There was dhobie itch on the inner surface of the right thigh and an area of itching dermatitis on the outer surface.

Laboratory Reports. — *Urine:* Trace of albumin, pus +++, a few red blood cells
Blood: Negative for malaria
Stools: Negative
Smears from Urethra: Positive for gonococci

Treatment. — The patient was put to bed with a suspensory bandage and an ice cap on the testicles. Urotropin and sodium benzoate $\bar{a}\bar{a}$ gr. X were given 3 times a day, and an injection of sodium iodide gr. XXXI was administered intravenously. On the 2nd day he was given 25 cc. of a 1% solution of mercurochrome for the prostatitis. Some relief of pain was noted. On the 4th day, a 2nd injection of sodium iodide was administered; following this, there was relief of pain and the patient rested quietly. However, the pain returned the next day, and on the 7th day a 3rd injection of sodium iodide was given. The patient was relieved of pain in the testicle after this injection. On the 9th day he was given a 4th injection of sodium iodide, after which there was a slight rise in the temperature; the following day, the dermatitis of the thigh was greatly aggravated. There has been no further complaint of pain in the testicle or epididymis. The patient remained in the hospital for some time under observation and treatment for prostatitis. During this time there was no recurrence of pain in the epididymis, although it remained slightly enlarged.

Case, M. C., Costa Rican, male, age 24 years.

History. — Gonorrhoeal urethritis for 20 days. Pain and swelling in the right testicle for 3 days; the pain was very severe and radiated upward on the right side. There was some pain on defecation.

Physical Examination. — Poorly developed and poorly nourished native. Many carious teeth. Spleen palpable 2 finger-breadths below costal margin. Purulent urethral discharge. Right epididymis swollen and painful. Prostate greatly enlarged and very tender.

Laboratory Reports. — *Urine:* Trace of albumin — pus
Blood: Negative for malaria
Stools: Ancylostoma
Smears from Urethra: Positive for gonococci
Meinicke test: Positive for syphilis

Treatment. — The patient was put to bed with a suspensory bandage and an ice cap on the testicle. An alkaline diuretic mixture was prescribed. On the morning of the 2nd day, he was given the 1st injection of sodium iodide gr. XXXI, intravenously. There was temporary relief, but the pain returned and was rather severe on the night of the 4th day. A 2nd injection was given on the 5th day; within 3 or 4 hours after this injection the pain practically disappeared and, with the exception of slight pain in the cord on the 6th day, he has had no further trouble from the epididymis. On the 7th day he received a 3rd injection of sodium iodide. Since the 6th day he has had no complaint and the epididymis is now practically normal. The patient remained under treatment for prostatitis and syphilis.

Case, A. R., Nicaraguan, male, age 28 years.

History. — Intense burning and pain on urination, accompanied by purulent urethral discharge, for 20 days. For 4 days he had pain in right testicle, which had become so painful that he could not walk, and had also been unable to sleep for 2 nights.

Physical Examination. — Inguinal and epitrochlear glands enlarged. Few carious teeth. Spleen-tip palpable. Right epididymis swollen and very tender. Slight swelling of scrotum and right testicle. Urethral discharge of thick yellowish pus.

Laboratory Reports. — *Urine:* Negative
Blood: Negative for malaria
Stools: Uncinaria
Smears from Urethra: Positive for gonococci

Treatment. — The patient was put to bed with a suspensory bandage and an ice bag applied to the testicle. An alkaline diuretic mixture was given, and codeine gr. ¼ p.r.n. was prescribed for the pain. On the 2nd day he was given an injection of sodium iodide gr. XXXI intravenously. The pain did not subside, and so on the 4th day he received a 2nd injection of sodium iodide. The pain was then relieved within a few hours, and the patient's general condition improved. On the 8th day there was no pain, and the swelling had subsided. A 3rd injection was given and he was discharged on the 11th day, having been free from pain for approximately 7 days.

He was seen later, in the out-patient clinic, and stated that he had been able to work as before and had no further pain.

CONCLUSIONS

(1) Next to operative treatment, sodium iodide intravenous treatment has proved most efficacious.

(2) Gonorrhoeal epididymitis is a common complication of gonorrhoea among laborers in the Tropics. It is disabling and usually requires weeks of hospital treatment. We believe this treatment to be of particular value in the presuppurative stage of this disease.

THE PERCENTAGES OF POSITIVE WASSERMANN REACTIONS FOUND ASSOCIATED WITH VARIOUS DISEASES

WALTER MENK, M.D.
Santa Marta Hospital, Colombia

Without going into details and without pointing out the obvious theoretically and practically interesting problems connected with these results, I shall give some percentages concerning the outcome of the Wassermann reaction in various groups of our hospital cases.

These results are collected from a series of cases that I had the opportunity to observe, from the end of August, 1926, to December 10, 1926, in the medical wards of the United Fruit Company's hospital in Santa Marta. The total number of cases from which these data were obtained was 309. This number relates only to those medical cases in the hospital that were really sick enough to demand more than a few days of hospital care.

TABLE 1

CLASSIFICATION OF RESULTS BY RACES

Races	No. Exam.	Per Cent Strongly Positive Reactions	Per Cent Clean-cut Negative Reactions
Negroes (Pure)	30	46.6	46.6
Negroid in type	20	50.0	45.0
Mestizos	171	27.0	51.2
Indians	35	40.0	45.8
Latin-Americans	53	15.0	68.0

We find from this analysis that the negroes and individuals with predominant negroid characteristics give the highest percentage of strongly positive Wassermann reactions.

If in malaria we have 23 per cent, and in amoebic dysentery we have 28.9 per cent, strongly positive Wassermann tests, it does not mean that these two diseases by themselves produce these positive reactions. Nearly all of the individuals that produced such reactions gave a history of, or showed physical signs of, syphilis or yaws. It is doubtful whether either pneumonia or nephritis influences the Wassermann test, and it is also doubtful whether persons with syphilis are especially prone to these diseases. Only an exact and extensive follow-up of this test, before the outbreak and after the cure of these diseases, can eliminate the doubt.

Most of our hospital cases suffer from several major or minor diseases at the same time. Thus, many of the cases observed in this study not only had the primary disease listed below, but were suffering also from other infections. For instance, when amoebic dysentery and typhoid fever appeared together in a patient, such a case was reported under amoebic dysentery, as well as under typhoid fever. Again, if malaria fever and nephritis appeared together, the case was recorded under malaria, as well as under nephritis.

TABLE 2

CLASSIFICATION BY AGE GROUPS

Age Groups	Per Cent Positive Reactions
Under 25	24.0
25 to 35	34.0
35 to 45	27.5
Above 45	35.0

TABLE 3

ASSOCIATED DISEASES IN SUSPECTED SYPHILITICS—ANALYSIS OF THE WASSERMANN TESTS

Diseases	Strongly Positive	Positive	Slightly Positive	Negative	Anticomplementary
65 cases malaria with positive blood film	23.0%	6.2%	3.0%	61.6%	6.2%
45 cases of clinical amoebic dysentery	28.9	8.9	0.0	46.7	15.5
55 cases of amoebiasis. No marked dysentery	25.5	3.6	0.0	58.2	12.7
13 cases of typhoid and paratyphoid fever	15.4	6.0	0.0	54.6	24.0
43 cases of pneumonia and pleurisy	35.0	4.6	0.0	51.0	9.4
27 cases of nephritis with marked albuminuria, casts	26.0	11.1	0.0	44.1	18.8
7 cases of nephritis with anasarca	28.6	28.6	0.0	14.2	28.6
44 cases of enlarged spleen and splenomegaly	20.0	9.0	0.0	51.0	20.0
(A) 32 with spleens 4-7 fingers below costal margin	12.5	12.5	0.0	53.1	21.9
(B) 12 with spleens more than 7 fingers below costal margin	41.7	0.0	0.0	41.7	16.6
Cases of Anaemia:					
(A) 56 cases with Hb. below 60%	25.0	8.9	3.6	42.9	19.6
(B) 78 cases with Hb. 60 to 70%	30.8	9.0	2.6	48.6	9.0
(C) 125 cases with Hb. 70 to 80%	32.0	4.0	0.8	53.6	9.6
(D) 48 cases with Hb. more than 80%	23.0	8.3	4.2	62.5	2.0
67 cases of caraate (pinta)	69.5	5.0	0.0	17.0	8.5
Total of 1,000 sera examined Aug. 25, 1925, to March 30, 1926	23.0	3.3	9.9	56.0	7.8

Positive Wassermann reactions were astonishingly high in cases of caraate (pinta) and splenomegaly. Whether or not the fungi which were present in the caraate infection positively influenced the Wassermann test is doubtful. According to general opinion, caraate is caused by fungi, and often the presence of fungi in scrapings from the diseased parts of the skin is striking. Nevertheless, the high percentage of Wassermann reactions found in this disease causes me to entertain some doubt as to whether the fungi which have been found are the primary cause of the various types of caraate occurring in our medical service at Santa Marta.

RESULTS OBTAINED FROM FOUR HUNDRED BLOOD EXAMINATIONS WITH THE MEINICKE TURBIDITY REACTION

Franz Weiss, M.D.

Quirigua Hospital, Guatemala

The following are observations made in the course of 400 blood examinations with the Meinicke Turbidity Reaction.

As already stated in previous Reports[1] of the United Fruit Company's Medical Department, the Meinicke reaction has always given very satisfactory results in other hospitals. I have obtained similarly good results with it. Among all cases tested, I never saw one with well-marked clinical symptoms of syphilis which was negative to the Meinicke test.

The literature often states that malaria can cause a positive Wassermann reaction. This is strongly contradicted by the investigations made by Dr. H. C. Clark, in Tela Hospital, Honduras, and by many reports from various tropical countries.

My own experience with the Meinicke reaction in cases of malaria confirms such reports. Among 400 sera tested there were, of course, many from patients with acute or chronic malaria. That in the great majority of the cases the Meinicke reaction was negative is ample proof that malaria in itself, as a rule, does not cause a non-specific Meinicke. Most of the cases of malaria that were positive to the Meinicke test had clinical evidence of syphilis. Whether, in the positive responses occurring in cases of malaria that were not suspicious for syphilis, the reaction was non-specific, we are not able to decide, since in this class of illiterate people syphilis cannot be excluded on the basis of the history and the clinical findings, alone. On the other hand, it is not uncommon to find that an uncomplicated case of malaria, when tested during the attack of fever, gives a doubtful or weakly positive response to the test, which, later on, when the period of fever has passed, becomes absolutely negative. Yet this is not characteristic of malaria only; it is a phenomenon well known to every serologist who tests the serum of a patient during the course of high fever.

Since the technique of the Meinicke reaction has already been thoroughly described, it is unnecessary to go into further details in this report. It may be worth mentioning here, however, that the reaction, according to the latest formula of Dr. Meinicke, is to be read after one hour's standing at room temperature, and once more, definitely, after two hours. Dr. Meinicke states that all turbidities which may eventually develop after this time are non-specific. My experience seems to confirm this statement.

Of great importance are the excellent durability and stability of the extracts, factors which make this test especially valuable for use in tropical countries. I have worked, for instance, with extracts nearly two years old; and when later on, receiving new extracts from Germany, I checked the old ones in a series of cases against the new, the agreement in the results showed that the old extracts had not lost any of their efficiency. Of course, they have to be preserved strictly according to directions.

Regarding the coagulation in the control tubes of some sera after the addition of formalin, I have met with this phenomenon 11 times among 150 cases. In the opinion of most of the authors who have studied the phenomenon[2] thoroughly, it seems to occur in connection with diseases accompanied by cachaexia or extensive destruction of tissue. My own experience, although very limited, verifies this.

Among the 11 cases mentioned above, there were 5 cases of grave malarial cachexia, 2 of cirrhosis of the liver, 2 (very advanced) of phthisis, 1 of empyema, and 1 of severe dysentery. All were very cachectic.

To prevent the coagulation of serum, which renders it useless for control purposes, I found the following method satisfactory: I wait until the extracts and salt solution are ready for use. Then I add the drop of formalin to the serum in the control tubes, shake them well, and immediately afterward pipette the extract mixture to the controls. If I have to examine more than 10 sera at once, I proceed as follows: First, I fill the control tubes of the first 10 sera; then I add the formalin to the controls of the next 10 sera; and immediately afterward, the extract mixture. Then, having finished with all tubes of the control row, I pipette the extract mixtures to the tubes of the 2 other rows to be tested. By this method I have nearly always succeeded in preventing a coagulation of the serum control, although in rare instances even this method is too slow.

The results obtained from the 400 blood examinations with the Meinicke reaction were as follows:

No. Cases	Pos.	Per Cent	Doubt.	Per Cent	Neg.	Per Cent
400	164	41	41	10.25	195	48.75

The incidence of positive reactions among the different races is given below:

Race	No. Tests	Pos.	Per Cent
Latin-Americans	312	117	37.5
Negroes and Mulattoes	72	44	61.1
Whites from temperate zone	16	3	18.7

Of course, the two tables above do not reflect the real community index of syphilis; it undoubtedly is very much lower.

The 400 cases tested were all especially selected, and most of them were suspicious for syphilis, a fact which explains the high percentage of positive findings for that disease. Nevertheless, these cases may be of some interest, as they demonstrate the relative index between Latin-Americans and negroes. Our results, in conformity with the reports from Tela Hospital, show that syphilis apparently is much more general among the negroes than among the Latin-Americans.

Twenty-one of the cases tested were undoubted syphilitics, with active lesions. All of them were strongly positive to the Meinicke test.

Among 6 cases, suspicious for syphilis of the nervous system, 4 were positive and 2 negative. One of the 2 negatives turned positive after provocation with neo-arsphenamine. That case is discussed in my report, "Comparison of the Meinicke Turbidity Reaction and the Kahn Precipitation Test" (see p. 177).

The number of leg-ulcer cases tested was limited to those that gave the clinical appearance of the typical *ulcus tropicum;* and of 31 cases, 15, or 48.4 per cent, were positive; 2, or 6.4 per cent, doubtful; and 14, or 45.2 per cent, negative. This, of course, does not prove that in 48.4 per cent of the cases the ulcer was due to syphilis, but it does show that at least 45.2 per cent of the cases were not caused by syphilis.

A lesion very frequently seen in our hospital is the soft chancroid, very often followed by buboes. Of 45 cases, 34, or 75.6 per cent, were negative, and 11 cases, or 24.4 per cent, were positive. I refer here only to cases in which the ulceration had persisted for at least 3 weeks (judging, so far as one can, by the statement of the patients), and which, therefore, if a mixed infection should exist, would be due to give a positive reaction. Most of the examinations were repeated after one week, with no change in the results. Thus 75.6 per cent of the lesions were certainly non-syphilitic. Whether the other 24.4 per cent were cases of recent mixed infection, or an acute chancroidal infection on a latent syphilis, it is impossible to decide from the results of the test. The percentage of mixed infections, however, certainly was not higher than 24.4.

Finally, it may be of interest to note that 4 of the cases tested suffered from buboes (so-called tropical or idiopathic) without chancres and with undetermined aetiology; 2 cases were positive and 2 cases negative.

REFERENCES

1. Cordes, W., on the Meinicke Turbidity Reaction, Annual Report of Medical Department, United Fruit Company, 1924, (p. 97), and Eichelbaum, H. R., "Meinicke Turbidity Reaction in Syphilis," *idem,* 1925
2. Pfeffer, *Klin Wochenschr.,* 11/497

A COMPARISON OF THE COMPLEMENT FIXATION TEST (WASSERMANN REACTION) AND MEINICKE'S TURBIDITY REACTION (M.T.R.) IN SERODIAGNOSIS IN THE TROPICS

WALTER MENK, M.D.

Santa Marta Hospital, Colombia

We have been using the Meinicke reaction (M.T.R.) together with the complement fixation method (Wassermann reaction) in the serodiagnosis of syphilis since the beginning of 1925. Both of these methods have been employed in our routine laboratory service for the following reasons:

1. We wanted to determine the comparative value of the two tests under tropical conditions.
2. We desired a good control test of this type to run parallel with the Wassermann test.
3. We often have cases admitted which require an immediate serodiagnosis. The Wassermann test is performed only once a week in our hospital, and during the intervals between the Wassermann days, we can easily and quickly apply Meinicke's test.

A comparison of the results of the two reactions can now be made on a series of 1,000 sera examined in our laboratory from August 25, 1925, to March 30, 1926. The sera were taken chiefly from those cases who were suspected of having syphilis; cases not under suspicion, as a rule, were not examined.

The application of the Wassermann test was made with the antisheep haemolytic system, and 2 antigens were always employed. We used a cholesterolized (0.4%) beef heart extract and a Noguchi's beef heart antigen in the first 549 cases of the series; 2 different cholesterolized antigens were used in the remainder of the series.

Meinicke's reaction (M.T.R.) was applied by using the two original antigens, the weak and the strong extract, as supplied by the Adlerapotheke in Hagen, Westfalen, Germany. We have been working since the beginning of 1925 with a mixture of equal parts of these strong and weak extracts, in order to simplify the test. This mixture of the extracts was diluted 1 : 10 with 3% sodium chloride solution. The technique of Meinicke's Turbidity Reaction has been carefully described by Dr. Wilhelm Cordes and Dr. H. R. Eichelbaum in the Annual Reports of the Medical Department of the United Fruit Company for 1924 (pp. 96–98) and 1925 (pp. 260–265), respectively.

Our results obtained by the use of the two methods for the serodiagnosis of syphilis will be classified along the following lines:

Wassermann Test. — By *strongly positive reactions* are indicated complete, or almost complete, inhibition of haemolysis. By *positive reactions* are indicated about 50 per cent of haemolysis; *slightly positive reactions,* 75 per cent or more of haemolysis; by *negative reactions* are indicated complete haemolysis. *Anticomplementary reactions* indicate those that show a marked fixation of the complement in the serum control tube which contains no antigen; the result of the test can not be read under such circumstances.

Meinicke's Test (*M.T.R.*). — *Strongly positive responses* are indicated by a very marked, milky turbidity or even, at times, precipitation. *Positive reactions* are indicated by a distinct turbidity in the main tube, as compared to the control tube. *Slightly positive reactions* show only a faintly increased opacity when compared with the control tube.

Control shows formation of gel (*c.g.*). — We must add to each heading in the Meinicke table a subdivision marked *c.g.* This means that the serum in the control tube has solidified on the addition of a drop of formol (liquor formaldehyde) required to stabilize the mixture of serum and extract dilution. We can not interpret the result of such a test.

Table 1, below, gives the results of the application of the two methods as applied to our total series of 1,000 sera. These sera include 221 specimens taken from patients under treatment in the dispensary (outdoor patients), and 779 specimens from cases under treatment in the hospital. The results obtained from the 221 outside cases are tabulated under Table 2, as a separate group, because there are some differences between the outcome of our total series and the results of our series obtained from out-patients. The latter, generally speaking, were not seriously ill and, therefore, represent a better-nourished group of people than the hospital cases.

TABLE 1

TOTAL SERIES OF CASES EXAMINED

Wassermann Tests		Number and Character of Meinicke's Reactions (M.T.R.)							
Results	Number	Negative	c.g.	Slightly Positive	c.g.	Positive	c.g.	Strongly Positive	c.g.
Negative . . .	560	484	33	26	1	12	3	1	0
Slightly Positive	99	26	4	41	0	16	0	8	4
Positive	32	5	0	1	0	9	0	16	1
Strongly Positive	231	1	3	0	1	14	0	183	29
Anticomplementary . . .	78	18	19	6	8	2	3	7	15
Totals	1,000	534	59	74	10	53	6	215	49

TABLE 2

SERIES OF DISPENSARY CASES EXAMINED

Wassermann Tests		Number and Character of Meinicke's Reactions (M.T.R.)							
Results	Number	Negative	c.g.	Slightly Positive	c.g.	Positive	c.g.	Strongly Positive	c.g.
Negative . . .	151	147	1	1	0	2	0	0	0
Slightly Positive	18	6	0	7	0	5	0	0	0
Positive	8	3	0	1	0	2	0	2	0
Strongly Positive	37	1	0	0	0	5	0	31	0
Anticomplementary . . .	7	3	2	2	0	0	0	0	0
Totals	221	160	3	11	0	14	0	33	0

A fair comparison of these two methods of serodiagnosis can not be gained if one presents only those reactions which agree completely with one another. It is necessary to classify contradictory and divergent results as well. We shall therefore count as a *contradictory reaction* a negative Wassermann test that coincides with a strongly positive M.T.R. test, and vice versa; as a *divergent reaction*, a negative Wassermann coinciding with a positive M.T.R., and slightly positive Wassermann occurring with a strongly positive M.T.R., and vice versa; as a *slightly divergent reaction*, a negative Wassermann and a slightly positive M.T.R., a slightly positive Wassermann and a positive M.T.R., a positive Wassermann and a strongly positive M.T.R., and vice versa. We arrive at the following results by means of this classification. The records in Table 2 show absolute agreement of the Wassermann and Meinicke's tests in about 84.6 per cent of the sera examined, absolute contradiction of results in 0.45 per cent, divergent results in about 2.3 per cent, and slightly divergent results in about 9 per cent of the sera tested.

Analysis of Table 1 presents about the same results if we count only the reactions of the sera that gave clean-cut results in the application of both tests, i.e., absolute agreement in 85.05 per cent of the sera, contradictory reactions in 0.24 per cent, divergent reactions in 2.97 per cent, and slightly divergent reactions in 11.74 per cent. We find, however, in the series of Table 1 that 7.8 per cent of the sera gave anticomplementary Wassermann reactions, while 12.4 per cent revealed solidification of the serum in the control tubes of the Meinicke's test. The out-patient series under Table 2 gave 3.17 per cent anticomplementary Wassermann tests and 1.36 per cent with formol gel in the Meinicke control tube.

The first important question that confronts us in the analysis is this: What percentage of agreement, under good and under bad serological conditions, can we expect to find in the results of these two methods, in cases where we have a clean-cut M.T.R. with a normal control tube? The total series (1,000) produced 87.6 per cent specimens that gave a satisfactory M.T.R. test in all tubes. This group of 876 sera with normal control tubes under the application of the Meinicke test gave absolute agreement between the Wassermann and Meinicke tests in 81.85 per cent, contradictory results in 0.23 per cent, divergent results in 2.85 per cent, and slightly divergent reactions in 11.3 per cent. We find, in addition, that 3.77 per cent of the sera gave an anticomplementary Wassermann reaction.

Really important differences are very rare between these two methods for the diagnosis of syphilis. The slight differences in diagnostic accuracy that are found in this analysis, however, appear to favor the M.T.R. test rather than the Wassermann test.

The second question of practical importance is this: What percentage of the total sera examined will give an M.T.R. test showing the formation of gel in the control tube, and what is the result of the Wassermann test in these cases? Of the series of 1,000 sera tested, 12.4 per cent showed solidification of the serum in the control tube of the M.T.R. tests. The Wassermann test gave an anticomplementary reaction in only 36.3 per cent of these M.T.R. tests containing solidified serum in the controls. We did not work out our anticomplementary Wassermann tests by repeating them or by using a more elaborate modification of the complement fixation test. In cases in which the control tube shows solidification of the serum, it is easier and quicker to repeat the Meinicke test than it is to repeat an anticomplementary Wassermann test. It is even better to repeat such unsatisfactory tests by applying the latest modification of Bruck's serodiagnosis for syphilis. This method is not so easily nor so quickly performed as the M.T.R., but it is more easily and quickly performed than any other precipitation test with which I am familiar.

We feel that all serological tests should agree with the clinical picture of the case. Comparing the outcome of both tests with the clinical evidence or probability of syphilis, we believe that the agreement between the M.T.R. and Wassermann tests is remarkably good, and that a positive M.T.R. coincides with a clear clinical, microscopical, and roentgenological diagnosis of syphilis or yaws as well as a positive Wassermann test. It is our belief that the M.T.R. test behaves very much like the Wassermann test when applied to cases with malaria—that is, uncomplicated cases of malaria very rarely give a positive response to the test. The technique of the Meinicke's test (M.T.R.) is so simple and time-saving that, considering our experience with it, we recommend its routine use for syphilis in the Tropics.

Anticomplementary Wassermann reactions and Meinicke reactions with solidification of the serum in the control tubes are our "crux." Generally speaking, patients in an emaciated, cachectic, or highly toxic state, and those people with chronic splenomegaly, form the group that produces such reactions.

COMPARISON OF THE MEINICKE TURBIDITY REACTION AND THE KAHN PRECIPITATION TEST

FRANZ WEISS, M.D.

Quirigua Hospital, Guatemala

As stated in previous reports[1], the Meinicke reaction has been checked, in a great number of cases, against the Wassermann and various flocculation reactions.

A series of 150 tests were made, simultaneously, with the Meinicke and Kahn tests, and the following results were obtained:

No. of Cases	Percentages	Results Meinicke React. and Kahn Test
137	91.4	Complete agreement
7	4.6	Disagreement
6	4.0	Slight difference noted

As to the 7 cases that showed complete disagreement, it is necessary to go into further detail. Of these, 4 showed a negative Meinicke reaction and a strongly positive Kahn test. The first case had cerebral symptoms, probably due to a gumma of the brain. The clinical diagnosis was lues cerebri. The Meinicke reaction was negative in the first examination, and the Kahn test strongly positive. After one week, during which time the patient had been given 0.6 gm. neo-arsphenamine, the Meinicke reaction turned positive also. The discrepancy between the reactions in this case cannot be explained, except by a failure of the Meinicke reaction.

The second case is similar: Syphilis in the latent phase was suspected, as the patient had enlarged glands, periostitis of the tibia, and a very suspicious history. The skin showed no evidence of syphilitic lesions. In this case, the Meinicke reaction was also negative on the first test, but turned positive on a repeated examination, and after the patient had had an injection of 0.6 gm. neo-arsphenamine. The Kahn test was consistently positive from the beginning.

The third case had blackwater fever, and the serum was examined during his convalescence. There was no clinical evidence whatever of syphilis. The Meinicke reaction was negative and the Kahn test strongly positive. In this case I am inclined to think that the positive Kahn test was non-specific. Of course, the absence of clinical symptoms of syphilis does not justify excluding the disease with certainty; on the other hand, we may suspect that in diseases like blackwater fever, which change the normal condition of the serum completely, there may be, besides haemolysis, other changes in the serum, unknown to us, which are likely to interfere with a flocculation test. In this case, a second examination of the serum, a week later, showed that the discrepancy was a persistent one.

The fourth case was malaria, and clinically not suspicious for syphilis; yet the Kahn test was positive, the Meinicke reaction negative. We cannot explain the discrepancy between the two reactions in this instance.

Again, there were three cases that showed a strongly positive Meinicke reaction and a negative Kahn test.

I believe that the Kahn test failed in the first of these cases. The patient had no clinical symptoms of active syphilis, but was very suspicious for latent syphilis. There were enlarged glands and periostitis of the tibia. He was in the hospital for treatment of a gunshot wound which was slow to heal. The Meinicke reaction was constantly strongly positive, the Kahn test negative. After an injection of neo-arsphenamine, a repeated Kahn test proved positive.

The second was a case of soft chancre with purulent buboes. The venereal sore resembled a typical ulcus-molle. As the Meinicke reaction was positive, the patient received an injection of 0.6 gm. neo-arsphenamine, and was put on mixed treatment. A second serum examination, a week later, showed also a positive Kahn test. This case was probably a mixed infection of *B. ducreyi* with *T. pallidum.* (The dark-field examination of smears made from the base of the ulcers was negative for *T. pallidum*—a not uncommon finding in mixed infections, especially when, as is the rule with our cases here, the ulceration is an advanced suppurating, neglected lesion.) According to the patient's history, the ulceration had existed for two weeks.

The third case was negative for clinical symptoms of syphilis. He had recently suffered from malaria, and the blood tests for syphilis were taken two days after the latest attack of malaria. We can give no reason for the discrepancy between the two reactions in this case.

Of the 6 cases in which a slight difference was noted, inasmuch as the Meinicke reaction was negative, and the Kahn test very weakly positive (a so-called doubtful reaction), one was an atrophic cirrhosis of the liver (Laënnec), following chronic alcoholism; another was a case of blackwater fever; and a third was a case of cardiac insufficiency with general anasarca. The other three cases had malaria. None of the six cases showed symptoms of syphilis.

In the first three of these six cases, the doubtful result of the Kahn test was possibly non-specific; they belong to a group of diseases which, we know from experience, are likely to cause non-specific serum reactions. Whether in the three cases of malaria the Meinicke reaction failed or the Kahn test was non-specific, we are unable to state. As the result of the Kahn test in this group of cases was too indefinite to be of diagnostic value, we do not consider that a real discrepancy existed between the two reactions.

The two tests frankly differed, therefore, in only 7 (4.6 per cent) of 150 cases, while they agreed in 143, or 95.4 per cent. These results agree closely with all comparisons of the various sero-reactions for syphilis. Klopstock and Hilpert[2], for instance, in their comparisons of 4 different reactions—including the Wassermann and the Meinicke's Turbidity—found in 5,663 cases an agreement of all 4 reactions in 92.04 per cent and a discrepancy in 7.96 per cent.

The technique of both reactions has been described in detail in the medical literature, and need not be referred to here.

The greater simplicity of the technique of the Meinicke reaction as compared with that of the Kahn test is certainly an advantage. In dealing with such small quantities of antigen as those required in the Kahn test, small errors in pipetting, no matter how carefully the process is carried on, are much more likely to occur and be overlooked than in the Meinicke test. Moreover, in the Kahn test, as compared to the Meinicke, the final judgment in reading the results is probably more subject to individual differences of opinion, especially in weakly positive cases.

CONCLUSIONS

In a series of 150 cases tested, simultaneously, with the Meinicke Turbidity Reaction and the Kahn Precipitation Test, there was an agreement in 95.4 per cent of the cases, and a disagreement in 4.6 per cent. So far as the limited number of cases permits of conclusions, we found both reactions equally satisfactory, from the standpoint of results.

In no case was either of the two tests negative in a patient with positive clinical symptoms of syphilis.

From a technique standpoint, we consider the Meinicke reaction preferable, because of its greater simplicity and the facility with which the results can be read, the liability of technical mistakes being thus decreased.

We believe that the Kahn test is a little too sensitive, and therefore more liable to give a weak, doubtful reaction in a non-specific case.

REFERENCES

1. Eichelbaum, H. R., "Meinicke's Turbidity Reaction in Syphilis," Annual Report of Medical Department, United Fruit Company, 1925, and Cordes, W., "Meinicke's Reaction," *idem*, 1924

2. *Klin. Wochenschr.*, 5th Jahrg., No. VII

BUTLER'S SERUM DIAGNOSIS FOR SYPHILIS A MACROSCOPIC SLIDE METHOD

(Preliminary Report)

H. C. CLARK, M.D.

The advent of the complement fixation test for syphilis (the original Wassermann reaction, as well as Noguchi's, Craig's, Kolmer's, and other modifications of it) was a tremendous advance in the direction of accuracy in the diagnosis of syphilis, and helped not only to reflect more nearly the correct incidence of the disease, but to furnish a gauge on the result of a course of treatment. All of these tests require considerable time, rather extensive laboratory equipment, and extreme care in the application of a technique that involves the use of several reagents. Such a test depends for its value, to a large extent, upon the ability of the person who performs it, and demands a conscientious technician who has had considerable experience. Large hospitals and board of health laboratories can conveniently apply such tests, but this is not true of many small organizations that are forced to cover a rapid turnover in hospital services and a large dispensary service, nor is it true in some classes of office practice.

The interval required for the test, as well as its complicated technique, has for many years stimulated efforts to devise a simple, time-saving method that might replace the Wassermann reaction. Numerous flocculation, precipitation, and turbidity tests have been presented for this purpose. Such methods did not attract much attention until a few years ago. The appearance of Meinicke's test (third modification), the Sachs-Georgi, and the Kahn reactions apparently gave satisfactory results but Kolmer's[1] estimate of the practical value of the precipitation tests of this period was as follows:

> Summing up the subject, it may be stated that the precipitation reactions are not as sensitive as the complement fixation reactions conducted with a technically correct and acceptable technique; that they are more subject to misinterpretation and should not be relied upon *alone* for the serum diagnosis of syphilis.

Meinicke's third modification (D.M. 3) and Meinicke's Turbidity Reaction (M.T.R.), as well as Kahn's test, at the present time are giving results that compare very favorably with well-executed Wassermann reactions. The successful advance of these tests soon led to further efforts at simplification by attempting to devise a micro-method or slide-method in serum diagnosis. Meinicke and Gross[2] have successfully applied the principle of the (M.T.R.) test to a micro-slide method, and more recently Butler[3] has devised a very simple precipitin macro-slide test for the diagnosis of syphilis. Inactivation of the serum is unnecessary in his method, and the results are immediate and easily read with the unaided eye. The method requires no period of incubation. Butler states that weak positive reactions should be disregarded for diagnostic purposes. In general, he believes that his test is not as delicate as a properly performed Wassermann. He advises against applying it in the presence of high fever, in moribund conditions, or upon haemolyzed blood specimens. His experience indicates that this simple test shows a high degree of selectivity for Wassermann positive bloods. A summary of his parallel tests (500) with the Wassermann shows complete agreement in 95.6 per cent, and with the Kahn test in 97.9 per cent.

A reliable test of this nature would be very desirable in our tropical medical stations, and such results encouraged us to give it experimental application. Dr. Butler very kindly supplied us with a sufficient amount of his antigens to give the method a trial. We have now received reports on its use from several of our medical units. These are summarized as follows:

Hospitals	Number of Sera Tested	Close Agreement with M.T.R. (Per Cent)	Close Agreement Kahn's Test (Per Cent)	Close Agreement Wassermann Test (Per Cent)
Santa Marta	273	77.2		72.5
Tela	407		75.6	
Preston	78	85.8		
Truxillo	35	91.4		
Almirante	100	93.0		
Quirigua	50	94.0		

Some members of our staff have expressed themselves in a very favorable manner in regard to the Butler test, while others have been more guarded in their expressions. Truxillo Hospital checked its cases that showed wide variations in results between Meinicke's M.T.R. and the Butler method, by applying Meinicke's third modification (D.M. 3) to the cases in question, and in these instances the results agreed with the M.T.R. reactions.

Tela Hospital checked its sera that showed a wide divergence in reactions against the clinical knowledge of the cases involved, and they believe that the Kahn test gave the more reliable information.

Preston Hospital (Dr. Cordes) has the following to say regarding the new method:

> The Butler test is very simple in technique and allows quick results. Its disadvantage, compared with Meinicke's (M.T.R.) test, is in the difficult reading of negative sera. A strongly positive serum stands out, immediately after mixing the serum and antigen-dilution, with a heavy white flocculation; many apparently negative sera show an unspecific precipitation after five to ten minutes. For this reason, the direction given by Butler insists on a two-minute limit for reading the test. It is sometimes hard to decide whether a serum is negative or positive, even within the two-minute limit. The Butler test seems useful in the rapid diagnosis of a strongly positive case, but for fine interpretations other methods should be relied upon.

The Wassermann test, Meinicke's (M.T.R.) test, and others that might be mentioned offer us control measures that supply information regarding anticomplementary reactions, formol gel results, etc. Without this means of control a certain percentage of non-specific reactions would be read as positive. It is important to know such facts and to have some means of control. We do not see in the Butler test any indicated method of control. It is also apparent that the test does not lend itself so conveniently to gauging the effect of a course of treatment. The technique fails to offer any advice for applying the test to specimens of spinal fluid.

It must not be forgotten, however, that Butler has given very clear advice on the interpretation of his test: " . . . strong positive reactions usually conform to the intensity of the Wassermann reaction, and weak positive reactions should be disregarded for diagnostic purposes." This test appears to command an important field of usefulness in the rapid application of such a test to a community survey, in making a quick provisional diagnosis in private practice, as well as in hospital and dispensary services not equipped with laboratories. It should also be very useful to the ship surgeon.

REFERENCES

1. Kolmer, J. A., Quoted by Stitt on page 256 of "Practical Bacteriology, Blood-Work and Animal Parasitology," by E. R. Stitt, 7th Edition, Blakiston's Son and Co., Philadelphia
2. Gross, Martin, "Zur Technik der Meinicke-Mikroreaktion auf Syphilis," *Dermatologische Wochenschrift*, Nr. 19 (Bd. 8), 8 Mai, 1926
3. Butler, H. W., "A Simple, Rapid Precipitin Test for the Diagnosis of Syphilis," *New Orleans Med. and Surg. Journ.*, No. 105–106, Vol. LXXIX, No. 2, August, 1926

SECTION V

SCHICK TESTS UPON INHABITANTS OF TELA, HONDURAS

WILLIAM H. TALIAFERRO, PH.D.

Numerous workers in various parts of the American Tropics have noticed the scarcity of clinical diphtheria. The diphtheria organism undoubtedly occurs in the Tropics, as is shown by such laboratory results as are given in the reports of the Health Department of the Panama Canal. Furthermore, small outbreaks of the clinical disease do occur. During the first part of 1927, Dr. R. B. Nutter has had several cases at Tela, and has found the organism in the throats of several other contacts. The presence of the organism, with the comparative scarcity of the clinical disease, makes it very interesting to ascertain the degree of antitoxic immunity in the general population, as shown by the Schick test.

In the present work, the right forearm was used for the Schick test itself, the left forearm for the control. Great care was taken to rule out any pseudoreactions. The Schick tests were carried out with diphtheria toxin supplied by the H. K. Mulford Company, and diluted with saline so that the amount for each test (1/50 M.L.D. for 250 gm. guinea pig) was contained in 0.1 cc.. The control tests were made with toxin heated to 75° C., which was supplied by Parke, Davis and Company.

Through the courtesy of Dr. W. E. Deeks, Dr. R. B. Nutter, and the United Fruit Company, we were able to make Schick tests on 82 patients and employees of the Tela Hospital (see "Adult" in table, p. 184). Of these, 48 men and 8 women were born in Honduras, 10 men in San Salvador, 3 men in Guatemala, 1 man in Mexico, and 6 men and 6 women in British possessions along the Caribbean Sea. Similarly, through the kindness and cooperation of Dr. Arturo Zelaya, of Tela, we made Schick tests on 48 boys in the school in Tela. These boys were all born in Honduras, their ages ranging from 7 to 14 years.

The results of the tests are given in the table on the following page.

The small number of individuals exhibiting a positive Schick reaction leaves no doubt that there is a high-grade antitoxic immunity (i.e., in so far as this test indicates immunity) in the general population of Honduras, just as there is in countries where clinical diphtheria is a widespread disease. Furthermore, although the numbers involved in the present survey are entirely too few to justify the drawing of conclusions, the results strongly suggest that susceptible individuals are even fewer in Honduras than in the large centers of the United States, such as New York City, where there are notably low percentages of positives.

Considering the results from the standpoint of age groups, the present data

Results of Schick Tests upon 130 Inhabitants of Honduras

Age	Number Tested	Number Positive (Susceptible)	Per Cent Positive
7	6		8.7
8	5		
9	3	1	
10	9	1	
11	12	2	12.0
12	5	1	
13	5		
14	3		
Adult	82	4	4.9
Total	130	9	6.9

also show consistently fewer positives. Thus, Park[1] has found 18 per cent of susceptible persons in a large series between the ages of 20 and 40 years (all of our so-called adults probably fall in this age group), whereas our figures indicate only about 5 per cent. Similarly, he finds 25 per cent positives in the group between 10 and 20 years, and 35 per cent in the group from 5 to 10 years; and Zingher[2], in a series of tests on children in baby health stations and vacation playgrounds, in Manhattan and the Bronx, found 22.5 per cent positives, from 11 to 14 years, and 36.5 per cent positives from 7 to 10 years. So far as our figures go, the percentage of positives in these groups is much lower.

REFERENCES

1. *Month. Bull., Dept. Health,* N. Y. City, Vol. xii, 1922, (p. 25)
2. *Journ. Am. Med. Assoc.,* Vol. lxx, 1923, (p. 456)

TELA HOSPITAL LABORATORY REPORT, 1926

James C. McDaniel, Laboratory Technician

Tela Hospital, Honduras

An important event in our serological work during the year was the shifting from the Wassermann test to the Kahn Precipitation Test. We did this after having proved, in our opinion, that the latter test was of greater value in the diagnosis of syphilis and that it could be carried out with much less time and expense.

We had formerly run the Wassermann test once each week, and found that it required the greater part of two days. Now we run the Kahn test twice each week, and have found the following points of distinct advantage: Acceleration of reports; saving of time and materials; no anticomplementary results; and a more sensitive test showing a higher percentage of authentic positives.

Before we discarded the Wassermann test, we ran parallel with it 118 Kahn tests with the following results:

26 positive cases showed complete agreement.
70 negative cases showed complete agreement.
2 doubtful cases showed complete agreement.
12 positive Kahn tests showed negative Wassermann tests.
5 doubtful Kahn tests showed negative Wassermann tests.
1 weakly positive Wassermann test showed a negative Kahn test.
2 anticomplementary Wassermann tests showed negative Kahn tests.

The group of 12 cases showing a positive Kahn test and a negative Wassermann test contained 5 cases with a past record of syphilis. On Feb. 20th, one of these cases had a primary lesion that was positive to a dark-field examination. The two tests were made on this case Feb. 25th, and the Wassermann test was negative, while the Kahn test was positive. Later, March 11th, this case gave a plus-minus Wassermann test, and the Kahn test remained positive.

The group of cases showing 5 doubtful Kahn tests associated with a plus-minus or negative Wassermann reaction consisted of 4 people with past records of syphilis, while the other had no previous record to support the result of the test.

During the past eight months we have run 1,607 Kahn tests, and 371 of these, or 23 per cent, were positive for syphilis. During the same eight-month period we performed 1,207 Wassermann tests, and 199 of these, or 16.5 per cent, were positive.

The bacteriological work for the year shows that we recovered from stools examined two cultures of the *B. paratyphosus B*. We deem this important because, prior to this time, nothing belonging to the paratyphoid group had been recovered here. The blood cultures done on these cases were sterile. The first case revealed a positive agglutination for *B. paratyphosus B* but the other case did not agglutinate against any of the group. Both cases ran a typical course of fever, with recovery.

We find it necessary to use at least three culture media, namely: bile, litmus milk, and broth. To observe each closely is of great importance. In a recent culture we recovered from litmus milk *B. typhosus*, which for some reason failed to grow in either of the other media named above. It also happens that febrile cases in this hospital frequently fail to give a reliable history of their illness. Therefore, any fever that can not be controlled within a day or two by the use of quinine is examined by blood culture, the three kinds of culture media being used.

The preparation of our culture media has shifted from the old method of preparation to the use of dehydrated media. Formerly, the time, work, and accuracy required for preparing a batch of agar necessitated the preparation of a large bulk, often more than could be used before it spoiled. We are able to prepare, at any time, just the amount of the dehydrated media needed, and thus have the satisfaction of knowing that it is fresh.

A glance at the Consolidated Laboratory Report (page 340) will suffice to give an idea of the vast number of malaria examinations that we conduct. To a great extent we have discontinued the use of the *thin blood film* in cases admitted to the hospital, but we prepare both the *thin and thick blood films* in dispensary cases. If the thin film is found positive, the thick film is discarded.

We still employ the eosin-iodine method in stool examinations, having found it to be most satisfactory. For further information and details of our laboratory work, reference is made to our consolidated report.

POST-MORTEM SUMMARY*

WALTER JANTZEN, M.D.

Truxillo Railroad Company Hospital, Puerto Castilla, Honduras

During the year 1926, 72 autopsies were performed in the Truxillo Railroad Company Hospital, Puerto Castilla, Honduras. Of these, 57 were Latin-Americans, 11 were negroes, 2 East Indians, and 2 Caucasians. There were 23 cases of lobar pneumonia — 21 in Latin-Americans and 2 in negroes. There were 12 deaths due to external violence. Excluding children under 15 years of age, the average ages were between 27 and 30 years, which corresponds closely to the average age of the employees who are treated in this hospital—i.e., ranging between the ages of 18 and 35 years.

As mentioned above, 23 autopsies were performed on patients who died from lobar pneumonia. This disease is responsible for more deaths than any other. Pneumococci were always present in the diseased tissues. Complications in these cases consisted of: Pleurisy with effusion, 4 cases; pericardial effusion, 2 cases; small tubercles in a number of cases, with more extensive involvement in 2 cases. In 4 cases there was found an inflammation of the descending colon and the rectum, showing a gray-greenish exudate firmly adherent to the mucous membrane. There was no extensive involvement of the large bowel in any case, and all of the lesions were in cases who had received intravenous mercurochrome (1¼ to 6 days before death). In one case there was a marked oedema of the descending colon and the rectum, this patient having received mercurochrome only 3 hours before death. Inasmuch as the above-mentioned changes were not found in any patient who was not given mercurochrome, it is thought that the drug is responsible for such inflammation. There were, however, no such changes in 2 other patients who received mercurochrome 4 and 6 days before death. Broncho-pneumonia was present several times as an accessory finding.

---

*All doubtful tissues in this series of cases were referred, for microscopical diagnosis, to Dr. F. B. Mallory, Consulting Pathologist, United Fruit Company, Boston City Hospital, Boston, Mass.

Lesions of the central nervous system were found in 5 cases: 3 cases with pneumococcic meningitis, and 1 with meningococcic meningitis, and in 1 case there was a cystic degeneration and atrophy of the region of the right central fissure (this patient had a hemiplegia of unknown aetiology, existing since childhood).

Diseases of the kidney were found in 6 autopsies. There were 3 showing the interstitial type of chronic nephritis with hypertrophy and dilatation of the heart. The average age was only 30 years (ranging from 24 to 35 years). The Meinicke reaction for syphilis was negative in all cases. In this group of cases, there was 1 of chronic nephritis, 1 of parenchymatous nephritis (microscopic), and 1 of acute nephritis (luetic?) in a case of congenital syphilis (microscopic examination). It is certain that a systematic microscopic examination of fixed renal tissues would have revealed more cases of renal diseases.

The cause of death from malaria was classified as follows: E.A. malaria (1), malaria cachexia (2), and blackwater fever (4). In 3 of the last-mentioned cases the heart showed considerable dilatation, and the urine was clear or contained on one occasion bile, which shows that the haemolysis had ceased some time before death.

Syphilitic changes were found several times. One native child died of congenital syphilis (microscopic examination), and in one case (an American) several gummata were found in the liver (incomplete autopsy). Syphilis of the circulatory system was the apparent cause of death in 4 cases; of these, there was 1 (32 years of age) with 2 aneurisms in the aorta, one of which had perforated into the oesophagus. Two cases showed syphilitic aortitis as an accessory finding.

Miliary tuberculosis and "cheesy" pneumonia were seen in one child. Another child died of measles complicated with broncho-pneumonia, bronchiectasis, and chronic amoebic dysentery. Smears from the dilated bronchi showed many spirochaetes of the Vincent type.

Carcinoma was found twice: A native of 24 years had a primary carcinoma of the liver (microscopic examination); and in the other case there was a carcinoma of the pylorus of the stomach, with metastases in the liver, both as accessory findings, lobar pneumonia being the cause of death. One patient died of sarcoma (microscopic examination).

Cirrhosis of the liver of the Laënnec type was found in 3 autopsies. Liver abscess with empyema and purulent pericarditis (incomplete autopsy) was found once. Another case showed purulent cholangitis and cholecystitis, and another a subphrenic abscess and pyopneumothorax following cholecystectomy.

Acute enteritis (in one case complicated with broncho-pneumonia) was twice the cause of death.

There was one case each of toxaemia of pregnancy, eclampsia, puerperal sepsis, and peritonitis after salpingitis.

Twelve patients died of external violence and its complications, such as peritonitis, haemorrhage, sepsis, etc., the principal causes being gunshot and machete injuries. In one of these cases there was found an obliteration of the pericardial sac, with an enormous calcification, so that the heart was literally enclosed in a calcareous shell. This patient had had no symptoms relating to the heart.

In 4 cases an accurate diagnosis could not be made; 2 of these were East Indians, who had been only a few months in this country. Both showed clinically a severe anaemia (15 to 20% hb.) with leucopenia and slight fever (about 100.5° F.) during their stay in the hospital; one showed E.A. rings in his blood. Both failed slowly, until death ensued without a marked feature of any disease. The autopsy revealed tigroid striation of the heart muscle, an extreme anaemia, and (microscopically) a central necrosis of the liver lobes. There was pigment in the spleen and the liver. A cause for the central necrosis of the liver and for the anaemia could not be found. There was neither clinical nor autopsy evidence of the picture of malaria cachexia. The possibility of a poison self-administered is suggested, but lack of knowledge of the language of this secretive people precluded any further investigation.

COMMENTS

According to the data given, one is led to believe that tropical diseases have little influence on the mortality rate. As mentioned above in this report, only 7 out of 72 of the deaths autopsied were due directly to malaria or diseases related to it (principally blackwater fever). There is undoubtedly, however, a lowered resistance caused by repeated attacks of malaria as well as by intestinal parasites, which no doubt unfavorably influence the course of pneumonia and other diseases that come to autopsy. Uncinaria infection is present to some degree in practically all patients, although it was not the cause of death in any case autopsied.

The enlarged spleen so commonly found at autopsy, often of enormous size, is probably caused by repeated attacks of malaria. In a great number of these cases, malarial pigment is found in the spleen and the bone marrow. These changes were found principally in Latin-Americans, in contrast to the negro race, which seems more resistant to malaria.

Intestinal changes resulting from dysentery were few, owing to the comparative infrequency of the disease or its complications as cause of death.

In lobar pneumonia the involvement of large areas of the lung tissue is frequent, not uncommonly three or four lobes being affected. Among Latin-Americans the high mortality from this disease is apparently due to a lowered resistance, resulting from chronic infections such as malaria and uncinariasis, as well as from the unhygienic mode of life and special racial qualities.

Tuberculosis, although a common disease here, has received little discussion, inasmuch as patients are encouraged to go to a more suitable climate as soon as this condition is diagnosed. Therefore, we have comparatively few autopsies on patients dying primarily from this disease.

FLUOROSCOPY AND ITS RELATIVE ADVANTAGES, COMPARED WITH RADIOGRAPHY, AND COMMENTS ON A NEW TYPE OF X-RAY FILM

SYLVIA BERG, M.D.
Tela Hospital, Honduras

The importance and significance of routine X-ray examinations in the clinic is so well established that a general discussion of its merits is unnecessary. We merely desire to call attention to the value of the fluoroscope, and to show that for examination of certain organs and demonstrations of certain pathological conditions, it not only is an aid to radiography but is the method of choice. In many instances fluoroscopic examinations alone can give exact results.

In the examination of the thoracic organs (lungs, heart and great vessels, oesophagus) as a preliminary step, fluoroscopy is necessary and should be used routinely to determine the localization and the extent of a lesion. By turning the patient from side to side and examining through different axes, we are able by fluoroscopy to ascertain which organ is the site of disease.

Certain conditions, such as mobility of the diaphragm, extent of a pleural effusion, exact localization of an interlobar process (thickenings, scars, empyema, tumor), and local relations of the various organs to each other and to the pathologic changes, can be determined only by fluoroscopy.

In pulmonary diseases, the radiograph gives us the finer details and is, no doubt, superior to fluoroscopy; but we cannot accurately observe by radiography the conditions previously mentioned.

In the examination of the heart and great vessels, fluoroscopy is also the method of choice, and alone is sufficient to make accurate diagnosis possible. Just here the final judgment depends on the examination in different axes of the body, on the type of pulsation, on the relations of the heart and great vessels to the mediastinum, lungs, and diaphragm, all impressions of which we get by fluoroscopy in a few moments, while radiography does not give them at all unless very complicated methods are employed.

Mention may be made here of orthodiagrams obtained by fluoroscopy. They are not as accurate as those made by distant photography or other photographic methods; but for the purpose of comparison of the condition of the heart at different times, and in examining in the same positions, they are inexpensive, absolutely reliable, and have the great advantage of being easily and rapidly made.

We repeat, therefore, that in the initial examination of the intrathoracic organs, fluoroscopy is of primary importance, but (especially in the examination of pulmonary diseases) the final and complete examination should be supported by the radiograph. We find, on the contrary, that in the complete examination of the digestive tract (oesophagus, stomach, and intestines), fluoroscopy is the only method by which an accurate diagnosis can be determined. On inspection of these organs, we have to consider the shape, size, location, and function; and peristalsis, mobility, and sensitiveness to pain. Data on the three last points one can never obtain by photographs, not even by the most elaborate serial pictures. Moreover, in order to test mobility and pressure points, not only the movable screen but also the palpating hand of the examiner is necessary.

For the digestive tract, the photograph aids us only in showing what is taking place at a characteristic moment; we may secure very beautiful pictures of an ulcer depression or of a tumor defect, but whether an hour-glass stomach or a stricture of oesophagus or intestine is caused merely by spasm or by an organic lesion can be decided only by fluoroscopy.

Finally, in the localization of foreign bodies fluoroscopy is an excellent aid, and in some cases is the only exact method. Its use is not confined alone to those cases in which we desire to fix by pencil marks the location of the foreign body in different planes, but it is often necessary, in cases of wandering foreign bodies, such as swallowed coins, needles, etc., to follow them for days through the body, a procedure which, if executed by X-ray pictures, would be very expensive.

The economy of fluoroscopy is an important consideration for any institution. We save not alone the expense of films, or plates, and chemicals, as well as electric current, but also time, and thus we arrive at our diagnosis immediately. The information secured by a two-minute fluoroscopic inspection of the chest is of inestimable value to the clinician, and can be very accurately made by an experienced examiner.

In making such short examinations we first visualize the trachea, and note its position, its breadth, and whether it is displaced by cicatrices (apical pulmonary lesions) or compressed by a struma (supra or substernal), enlarged thymus, or some other tumor mass, etc. Then we examine the chest and note the type of breathing; also the diaphragm, and mark its mobility—whether or not both sides are symmetrical in their excursion. Its shape may be changed by adhesions, and it may be displaced upward by some intra-abdominal pathological condition (liver-abscess, subphrenic abscess, etc.), or displaced downward as in emphysema or paralysis of the phrenic nerve; its shadow may be obliterated in pleural effusion.

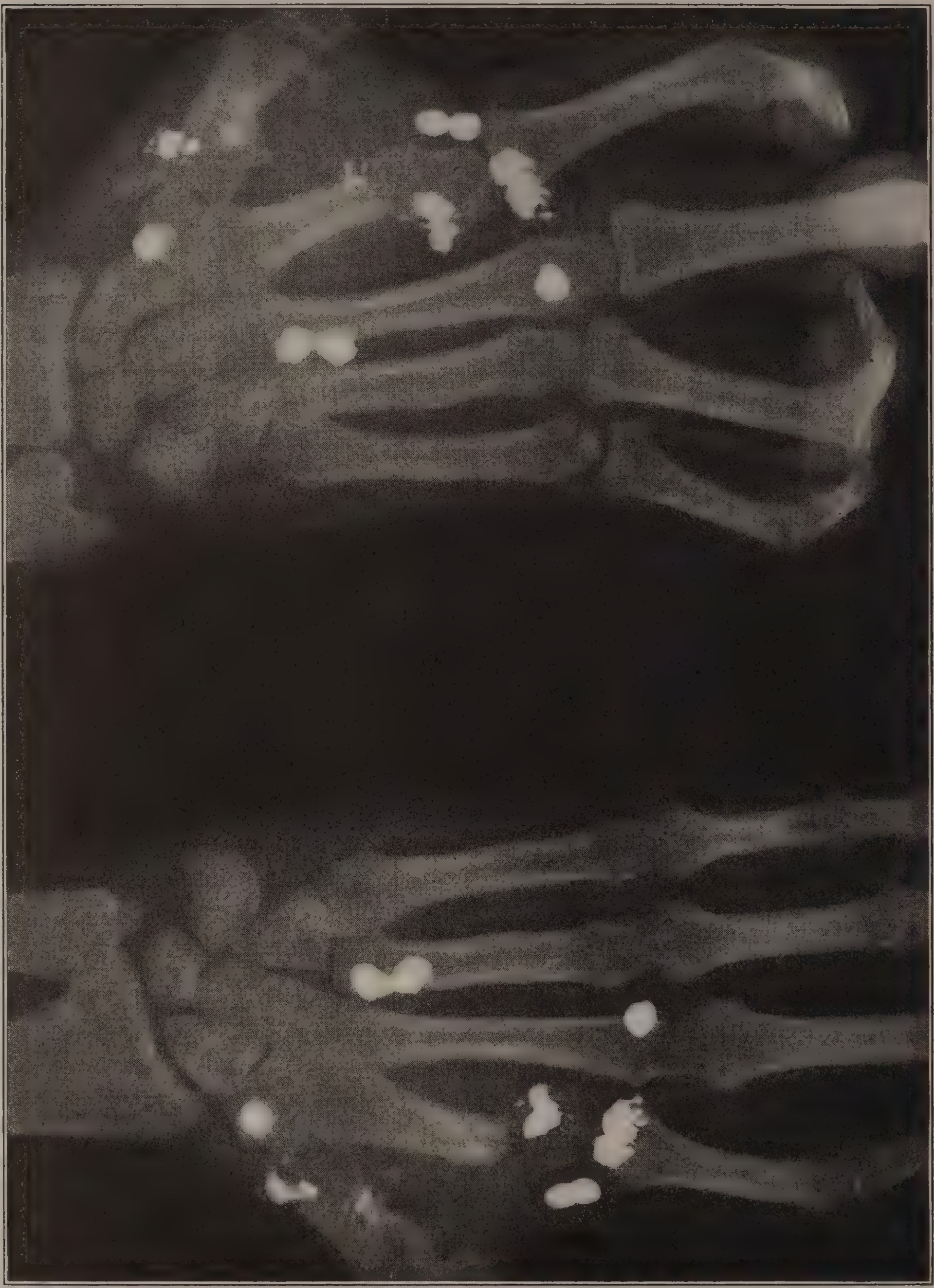
Special attention must be given to the costo-phrenic angles, which are often obliterated by minute scars or by a very small amount of fluid—a condition which is best observed by changing the position of the patient.

At a glance it is possible to visualize pathological conditions in the lung tissue, such as pneumonia, abscess, various types of tuberculous infiltration, and tumors or changes in the pleural cavities, such as effusions, pneumothorax, and adhesions. Not only do we see the gross lesions, but it is possible to detect the smaller healed processes, such as small calcified glands, fine interlobar scars, calcified primary foci, and so on. We determine, also, the condition of the apical fields, examining the patient with shoulders relaxed, and observing the apices during cough, from both the front and the back. The hila are inspected, with their glands and blood vessels, and finally the heart and great vessels are studied.

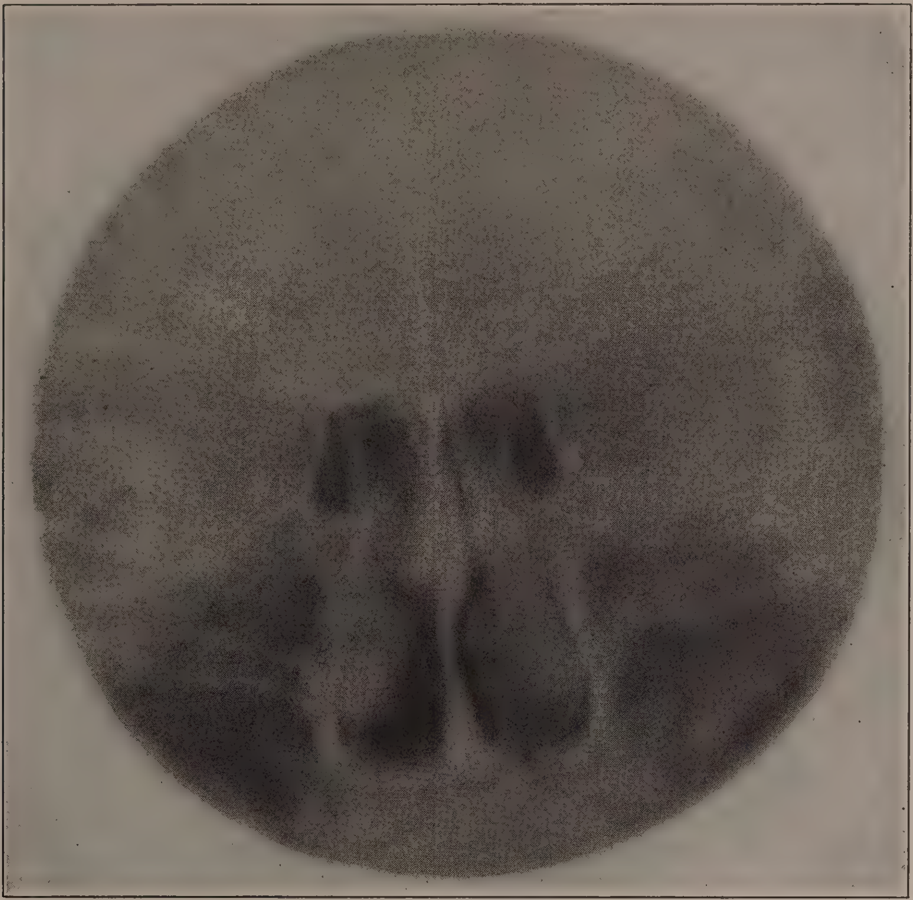
By the shape, size, and position of the heart, and the type of pulsation, we can determine whether or not there is abnormality; and if a lesion is present, we can with some degree of certainty differentiate a valvular lesion from a secondary change in the heart muscle due to nephritis, emphysema, and other conditions. Aortic diseases, such as sclerosis, dilatation, and aneurism, are recognized by variations in density, shape, and pulsation. Turning the patient laterally, we inspect the anterior and posterior mediastina, and may discover a pathological condition not visible in the sagittal axis. Such an examination enables the clinician to obtain an intimate knowledge of the patient's condition.

A NEW TYPE OF X-RAY FILM

A frequent objection to the use of ordinary gelatin-coated celluloid films for X-ray work in the Tropics has been the development of a mould or fungous growth on the films after the package has been opened. It is believed that the tropical climate and the humidity near the coast favor the growth of this mould. There has recently been perfected by a firm of Dresden, Germany, a new type of X-ray film which consists of a heavy paper, on one side of which is applied the silver salt emulsion. From our experience in the Tela Division, this film apparently is proof against such fungous growth. It is comparatively cheap, and permits of a direct positive radiograph which is perfectly satisfactory for most purposes. These films have to be exposed only one-third to one-half of the time used for ordinary films, and can be developed by the same developing and fixing mixtures, the time required being a little longer. They have to be carefully watched, and must be rinsed for from one-half hour to an hour in running water. The accompanying photographs (pages 192, 193) were made with these films.



X-ray photograph showing gunshot wounds of the hands. Note bullet fragments, fractures, and resulting deformities.



X-ray photograph showing veiled sinus maxillaris

SECTION VI

STREPTOCOCCAL SUBCUTANEOUS NECROSIS WITH GANGRENE OF THE SKIN

ALFRED GAGE, M.D.
Quirigua Hospital, Guatemala

Gangrene affecting any portion of the body is usually a lesion necessitating serious consideration. As there are many causes for its occurrence, it is of great importance to determine the aetiological factor in any given case, in order that proper treatment may be instituted as early as possible. Thus the loss of tissue can be reduced to a minimum and possibly life can be saved.

The cases reported below, of subcutaneous necrosis with subsequent gangrene of the skin, due to the short-chain streptococcus haemolyticus, demonstrate well the selective affinity of bacteria for specific tissue.

I had seen only a few cases of this condition until recently, when four came under my observation in rapid succession. The disease is certainly a definite pathologic entity and, as such, has been reported in the literature, though rather infrequently.

Meleny[1], in his exhaustive article, not only reviewed the literature, but studied the disease from all its angles. He states, "I have learned that the disease is fairly common in the Orient, but little has been written on the subject. A review of the general literature indicates that the condition is relatively rare in other countries, except for one small sub-group—viz., gangrene of the scrotum and penis. Individual case reports have been given by Seeman, Hawkins, and Stirling[2], while Campbell[3] has given an excellent description of 5 cases."

Of the cases herewith reported, three were of the extremities and one of the scrotum. The infection followed traumatism, in each case; in fact, I have never seen a case that did not give a history of trauma preceding the infection. These cases differ from those of Meleny in two respects: (a) The blebs or blisters were not a constant feature; and (b) the disease did not appear to be self-limited.

As the patients reported for treatment, and radical incisions were made before extensive gangrene of the skin had occurred, the question of self-limitation of the disease is not definitely settled.

In summing up the symptomatology, there are several points to be considered. In most cases, trauma—such as crushing injuries or contusions with considerable laceration of the skin—precedes the infection. An exception in the cases at present under discussion is the one that followed a slight abrasion of the scrotum with the finger nail. None of my cases followed incised or stab wounds. The lowered resistance of skin and subcutaneous tissue involved in lacerated and crushing injuries probably predisposes to the occurrence of the disease following this class of trauma.

After the process has begun, a well-defined area of cutaneous gangrene is seen surrounding the original skin trauma. The extent of this area of gangrenous skin depends on the duration of the infection; immediately surrounding the site of infection, it is black, gradually fading into green, greenish yellow, and yellow—all surrounded by a red, acutely inflamed area. Oedema, which is always present, may render the skin and the subcutaneous tissue firm and tense or soft and boggy in character. As a rule, the induration is most pronounced near the site of injury. In two of these cases, there were many pin-head ecchymotic spots in the skin over the affected area; these, however, did not extend as far out as did the area of underlying subcutaneous necrosis. These spots, when present, are confirmatory clinical evidence as to the nature of the infection.

Pain is a constant symptom. It is increased on slight motion of the infected part. Fever of a septic type is usually present, although overwhelming toxaemia may, for a short time, produce only a slight elevation of temperature. There is more or less severe prostration, accompanied by a rapid, weak pulse.

The infection spreads rapidly in all directions; its fulminating character is comparable to that of gas gangrene in the rapidity of its spread.

The skin necrosis is secondary to the subcutaneous necrosis, and is due to a thrombosis of the small subcutaneous blood-vessels. The extent of the subcutaneous necrosis can be determined only after incisions are made. It usually extends well beyond the superficial area indicated by the gangrenous skin. This was well illustrated in Cases 2 and 3. In Case 2, subcutaneous necrotic tissue extended well beyond the discolored skin, while in Case 3 it extended about three inches above and below, under apparently normal skin.

The treatment instituted in these cases consisted of radical incisions, through the skin and subcutaneous tissues, extending in both directions until healthy bleeding was encountered in uninvolved subcutaneous tissue.

On section, the infected tissue appears greenish black or yellowish green, is rather tenacious, and exudes small amounts of serous fluid. In the majority of cases, a pure culture of the short-chain streptococcus haemolyticus may be obtained from any part of the incision that shows the subcutaneous necrosis. The operative procedure which I have followed, and which I believe the most efficacious, is multiple incisions, with elevation of the flaps. Take, for example, a case of gangrene of the leg: Longitudinal incisions from 1½ to 2 inches apart are made through skin and subcutaneous tissues, and are extended in both directions until active bleeding is encountered in and below the skin. When the infection is widespread, it may be necessary to make these incisions over almost the entire circumference of the leg, and to extend them from the ankle to the knee.

The flaps thus formed should be elevated either at intervals or throughout their entire length. Wet packs of 2% mercurochrome, 4% boric acid, or Dakin's solution should be placed under all the elevated flaps. Then antiseptic dressings should be applied, and changed at frequent intervals. I have used that universal culinary utensil of the Tropics, a five-gallon kerosene tin, filled with a hot solution of potassium permanganate, for leg and foot cases. This container admits the limb up to the knee. Morphine, and cardiac stimulants, are given as indicated, and the patient is encouraged to ingest large amounts of fluids. The gangrenous sloughs separate after several days, leaving a granulating surface. In none of my cases was there involvement of a muscle or tendon.

If large areas are denuded of skin from sloughing, skin grafting should be done. Meleny[1] states that the small Reverdin grafts are best. I agree with this statement, as large grafts or long strips undergo necrosis more frequently than the tiny grafts. Though many of the latter may die, usually a sufficient number live to insure success.

SUMMARY

1. Subcutaneous necrosis with gangrene of the skin due to *Streptococcus haemolyticus* is not extremely rare in the Central-American Tropics.
2. The disease is a definite entity, and can be easily diagnosed in the majority of cases.
3. It usually follows trauma.
4. Early diagnosis and radical surgical treatment are essential.
5. The treatment of choice is: multiple incision, followed by constant applications of antiseptic solutions, preferably hot.

CASE REPORTS

The following selected cases are briefly reported. For detailed description of the pathology and bacteriology, the article by Meleny[1] is recommended.

Case 1. — White, adult male, Guatemalan. The skin and subcutaneous tissues were lacerated by a heavy box falling on the dorsum of the left foot. (The patient was wearing shoes and socks at the time of injury.)

The wound was treated by local physicians for three days prior to admission to the hospital, at which time the foot was swollen, red, and painful, the process having extended up to the middle third of the leg. His condition appeared highly toxic. He had a septic type of temperature, and a rapid and weak pulse. The following morning with Dr. Aguilar, my associate, I saw the patient in consultation with Dr. Macphail, Superintendent of Quirigua Hospital. At this time the skin at the edges of the wound was black. The dorsum of the foot above the injured area was yellow, with numerous ecchymotic spots which extended well above the ankle joint. There were no blebs. Pitting on pressure was observed about the ankle. The patient was nervous and apprehensive, although not complaining of pain when the foot was at rest. Immediate operation was advised, and the patient concurred. Multiple incisions were made from below the original lesion, upward, until free bleeding was encountered in the subcutaneous tissues. As is usual in these cases, the color of the skin was no certain indication of the extent of the subcutaneous necrosis.

Wet antiseptic dressings were applied, and renewed at frequent intervals. In spite of this treatment the patient succumbed within a short time, with a clinical picture of septicaemia. The process was exceedingly rapid, the patient being literally overwhelmed by the infection. I believe the chances for recovery in this case were considerably lessened by the patient's delay in reporting for operative treatment, and possibly the surgical procedure was not sufficiently radical.

Smears and cultures were positive for the *Streptococcus haemolyticus*.

Case 2. — White, adult male, American, residence Guatemala City.

The end of a steel rail had been dropped on the right foot, producing superficial lacerations of the toes, and dorsum of the foot, and fractures of the second, third, and fourth phalanges. The patient was admitted to the hospital on the third day after injury.

The patient was apprehensive. Temperature was only slightly elevated, but pulse was rapid. The foot was slightly swollen, and the skin over the dorsum and lateral portions was yellow, showing many pin-head ecchymotic spots. The skin around the wounds on the dorsum of the foot and on the fourth toe was black and indurated. On pressure, there was pitting, which extended upward to about one inch above the internal malleolus. A clinical diagnosis of *Streptococcus haemolyticus* subcutaneous gangrene was made.

An immediate operation was performed, consisting of multiple incisions over dorsum and lateral portion of the foot, carried upward until active bleeding was encountered. The flaps were elevated and packs of 2% mercurochrome inserted. These packs were changed daily. The dressings were kept constantly wet with equal parts of 4% boric solution and 95% alcohol. The patient had a steady and uneventful convalescence and was discharged, cured. There were two small skin sloughs, one over the dorsum of the foot and the other over the fourth toe at the site of original injury.

Smears and cultures taken from the subcutaneous tissue were positive for the *Streptococcus haemolyticus*.

Case 3. — Adult male, Guatemalan.

Four days prior to admission to the hospital the patient fell, lacerating the skin over the middle third of the right tibial crest. On date of admission he had a temperature of 102° F., rapid pulse, and great pain in the leg, which was intensified on motion. Immediately surrounding the original lesion there was a black area of skin (about the size of a silver peso) which gradually shaded into green, then yellow, the most distant zone being red. The entire leg was swollen and rather tense, the oedema extending about six inches above and below the wound. On pressure, a thin sero-purulent fluid exuded from wound.

Operation was immediately performed. Multiple longitudinal incisions were made, and it was noted that the subcutaneous necrosis extended as far upward as the knee, and downward to the ankle joint. The subcutaneous tissue, showing the typical greenish-yellow color, was tenacious, with no haemorrhage on section. (In the cases I have seen, the large vessels have not been thrombosed.) The flaps were elevated and 2% mercurochrome packs inserted. These were changed daily. The foot and leg were given frequent immersions each day in hot potassium permanganate solution, with a five-gallon kerosene tin as the container.

Convalescence was steady, and satisfactory, although the area of gangrenous skin became larger, immediately surrounding the original injury. There was considerable sloughing and retraction of the skin, in this case, which may have been due to a too extensive and almost complete elevation of flaps. Reverdin skin grafts were applied by my associate, Dr. Aguilar. The progress of the case was entirely satisfactory.

Haemolytic streptococci were obtained in cultures taken from several of the incisions.

Case 4. — F. J., adult male, age 52 years, Jamaican, residence Guatemala.

About seventeen days prior to the patient's admission to the hospital, a lesion began as a "pimple" on the left side of the scrotum. He scratched this with his finger nail, and two days later the area became red, swollen, and painful. The entire scrotum continued to swell, and finally, pus began to exude from many small openings. He tried various "leaf poultices" but the condition steadily grew worse.

Physical examination revealed emaciation and general arteriosclerosis. The pulse was rapid and weak. The temperature was about 100° F. The patient was not prostrated, nor did he appear very toxic. There was no penile lesion nor inguinal adenitis present. The scrotum was swollen to the size of an average cocoanut. There were a great many punctate openings in the skin from which a thin, purulent fluid of offensive odor could be expressed. The scrotal skin was about one inch in thickness, oedematous and boggy, easily pitting on pressure.

Operation was performed immediately. An incision the entire length of the scrotum revealed a gangrenous condition of the skin, the subcutaneous tissue, and about two-thirds of the tunica vaginalis. The testicles were not involved in the gangrenous process but were covered throughout with a thin layer of bright-red granulation tissue. A small area of skin high on the posterior surface of the scrotum did not show gangrene. Practically all of the gangrenous tissues were resected. The entire area was then washed with normal saline solution, dried, and covered with 2% mercurochrome solution. Wet packs of the same solution were then applied.

Subsequent treatment consisted in the continuous application of thick pads of gauze saturated with a 4% solution of boric acid. Thirty-minute sitz baths were given three times daily as soon as the patient was able to sit up.

The convalescence was very slow, but steady. The patient would not allow skin grafting and I doubt seriously whether it would have been successful. Unfortunately in this case the culture material was lost, but smears showed short-chain streptococci and staphylococci.

There is little doubt that the gangrenous condition in this case was due to infection with *Streptococcus haemolyticus*, and that the staphylococcus was a secondary invader. The patient was cured of the infection, and was discharged, able to work.

BIBLIOGRAPHY

1. Meleny, Frank L., "Haemolytic Streptococcus Gangrene," *Arch. of Surgery*, Vol. IX, No. 2, Sept., 1924, (p. 317)
2. Stirling, W. C., Jr., "Gangrene of the Scrotum and Penis," *Journ. Am. Med. Assoc.*, Vol. LXXX, Mar. 3 1923, (p. 622)
3. Campbell, M. F., "Streptococcus Scrotal and Penile Gangrene," *Surg. Gyn. and Obst.*, Vol. XXXIV, June, 1922, (p. 780)

SEVERE FRACTURES INVOLVING THE KNEE JOINT

B. M. Phelps, M.D.

Puerto Castilla Hospital, Honduras

Fractures involving the knee joint are usually troublesome, and are quite liable to cause considerable disability. Strength of the knee and ability to bear weight without pain are desirable end results. Because of the very satisfactory end results obtained, we are reporting here a case of a severe fracture involving the knee. The method of treatment is probably open to criticism on several points.

CASE REPORT

J. M., white, Spaniard, age 41 years, a passenger on one of the steamers, was admitted to the hospital at midnight, April 26, 1926, apparently in great pain. While he was crossing between two fruit cars on the wharf, just as the engine backed into the train, his left knee was caught between the draw-bars.

Examination showed the left knee greatly swollen, tender, and with several slight abrasions of the skin. X-ray examination (see Plates No. 1–1A) revealed a simple comminuted fracture of the lower end of the femur, with intercondylar separation, and with fragments displaced; also, an irregular transverse fracture of the patella, with displacement; and a comminuted fracture of the upper end of the tibia, running into the joint, with displacement upward of the external condyle.

There was considerable shock and prostration. The leg was placed in a fracture box, and the knee packed in ice, and the patient was given sufficient morphine to relieve the pain. The following morning, under novocain anaesthesia, calipers were inserted (see Plate No. 2) above the condyles of the femur; the leg was placed in a Thomas wire splint with flexion of the knee to about 30 degrees and of the hip to about 20 degrees; and the whole splint was suspended from a Balkan frame with weights and pulleys. This permitted free movement of the body without disturbance of the fracture seat. Weights, beginning with 10 pounds and gradually increased, were applied to the calipers through pulleys, and a gentle manipulation of fragments was performed until a fair alignment was obtained.

On account of a severe bronchitis, no general anaesthetic was used, and fear of infection precluded any open operation to repair the patella at this time.

On May 14th, the calipers were removed and a straight Thomas splint was substituted, this being done to relieve the patient of an uncomfortable position and to prevent ankylosis of the knee in a position of flexion. At the same time, massage, gentle passive motion, and heat applications were begun. On May 26th the patient was practically free from bronchitis and, under ether anaesthesia, the two fragments of the patella were approximated with silver wire. Considerable retraction of the quadriceps tendon was encountered, and it was impossible to bring the fragments into correct anatomical position. The wound healed by first intention and the patient was out of bed on June 5th. Slightly forced flexion was practiced daily with a continuation of massage and heat applications.

On June 28th the patient began to bear some weight on leg (see Plates No. 3–3A) without suffering pain, and had an estimated passive range of movement of 20 per cent with an active range of about 10 per cent. There was some foot drop. The position of the foot was correct, but there was a 1-inch shortening of the leg.

On July 17th the patient left the hospital, walking with a cane, and he bore his weight without pain. There has been some increase in the range of active movement. Weakness in the leg muscles and a slight amount of foot drop remain.

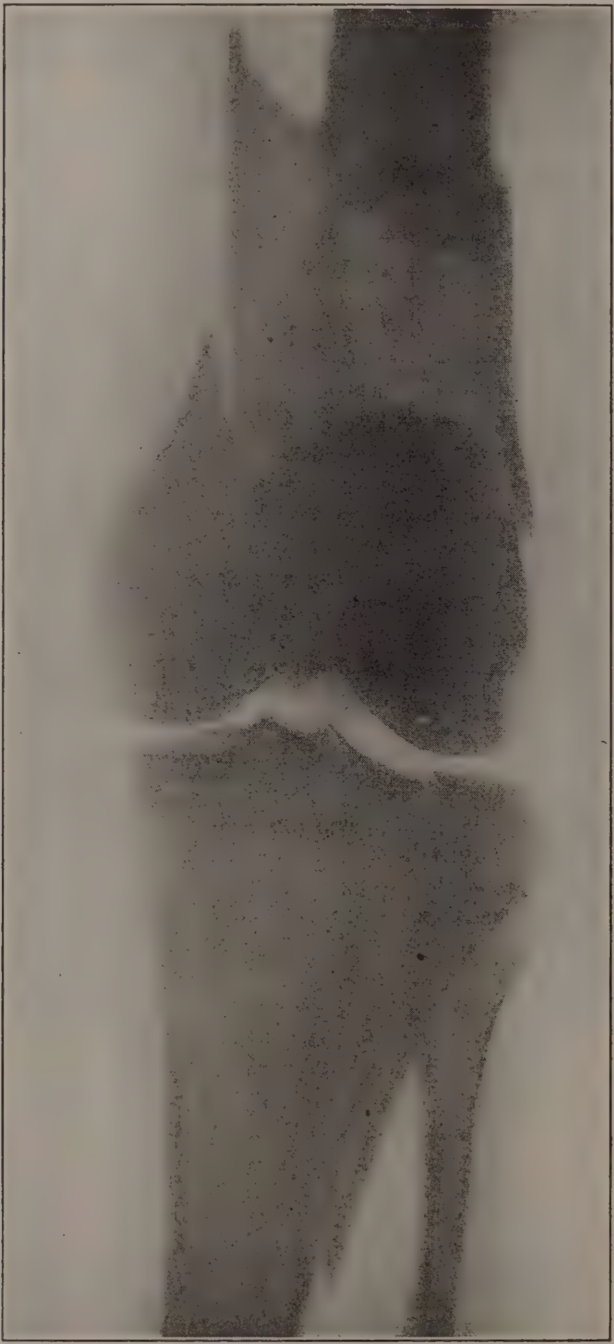


PLATE No. 1

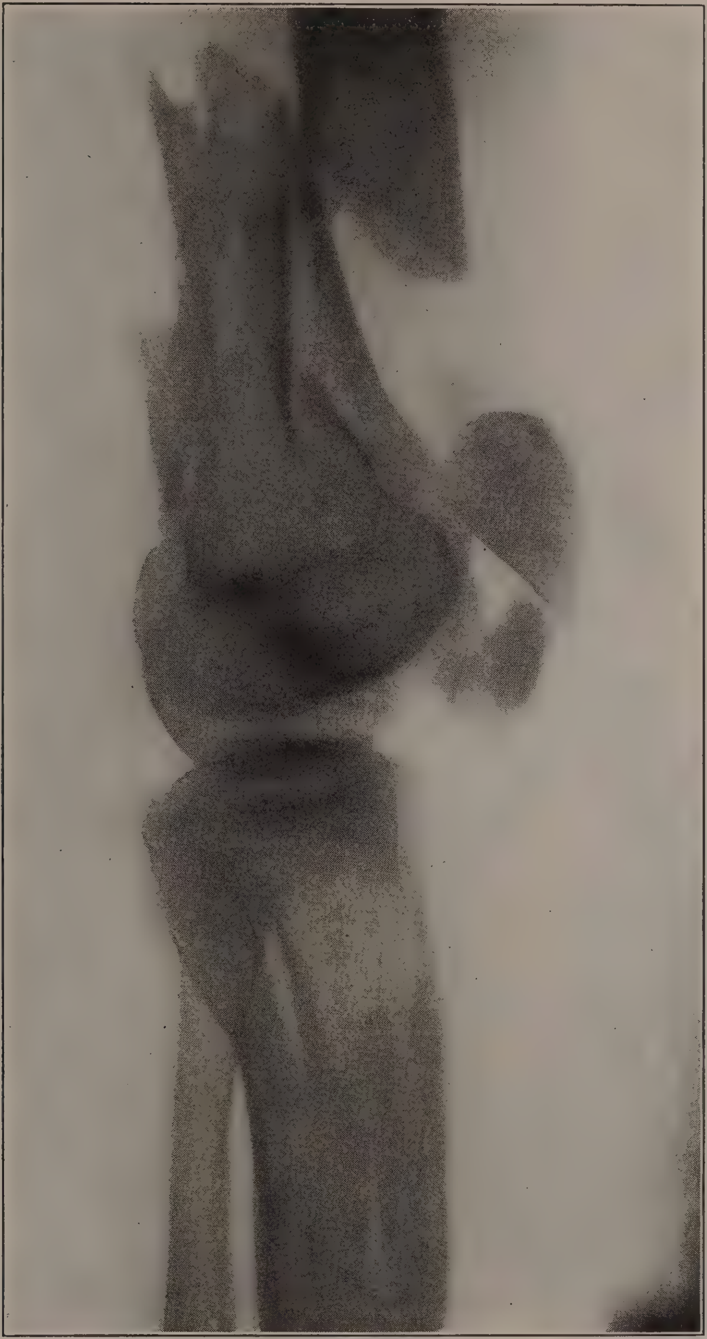


PLATE NO. 1 A
Side view of fracture shown in Plate No. 1

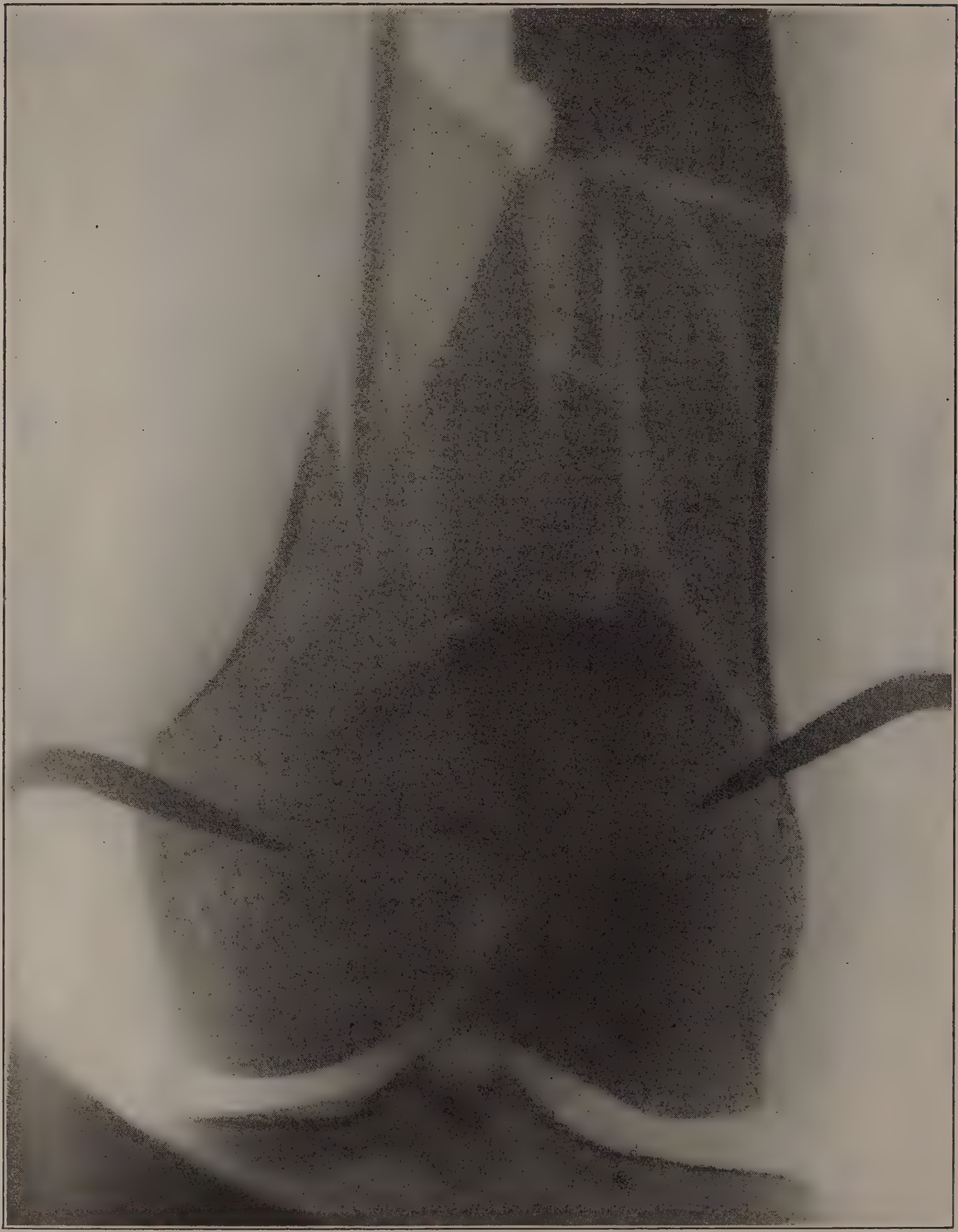


PLATE No. 2

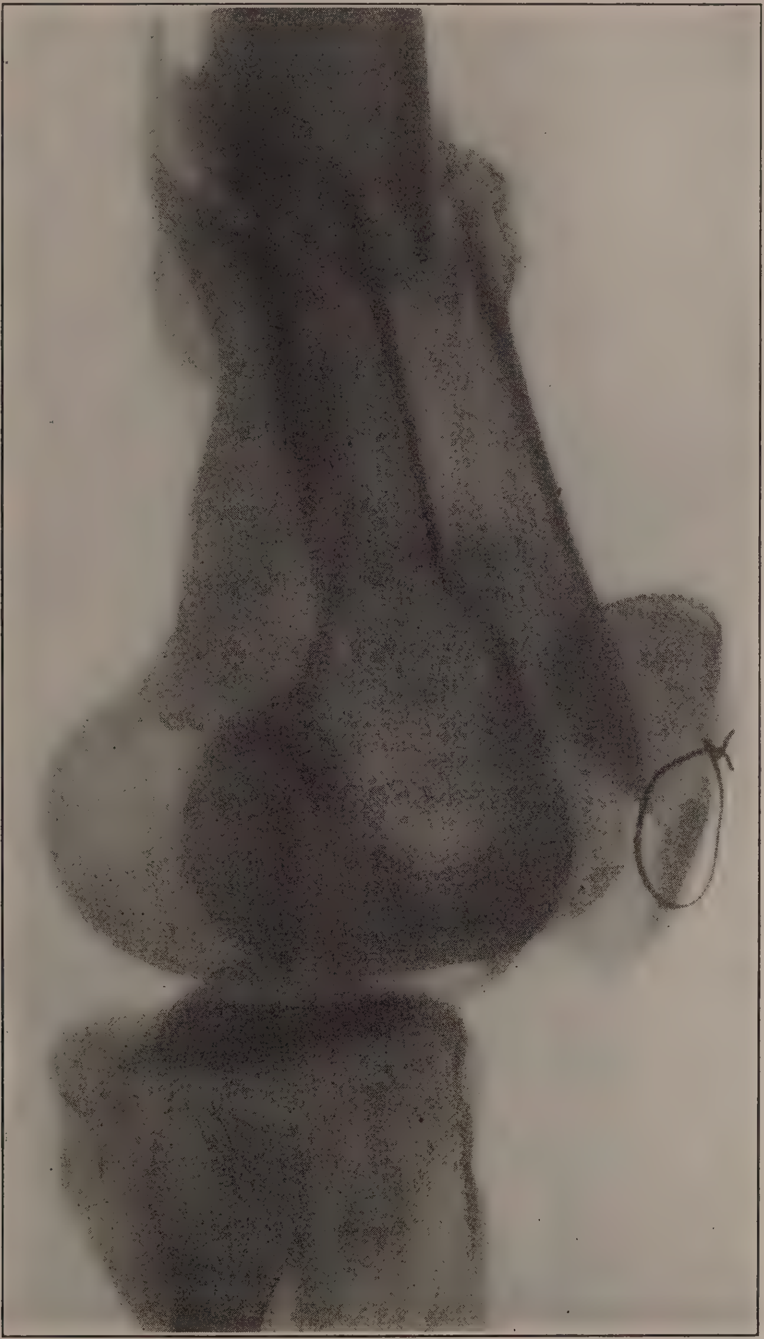


PLATE NO. 3

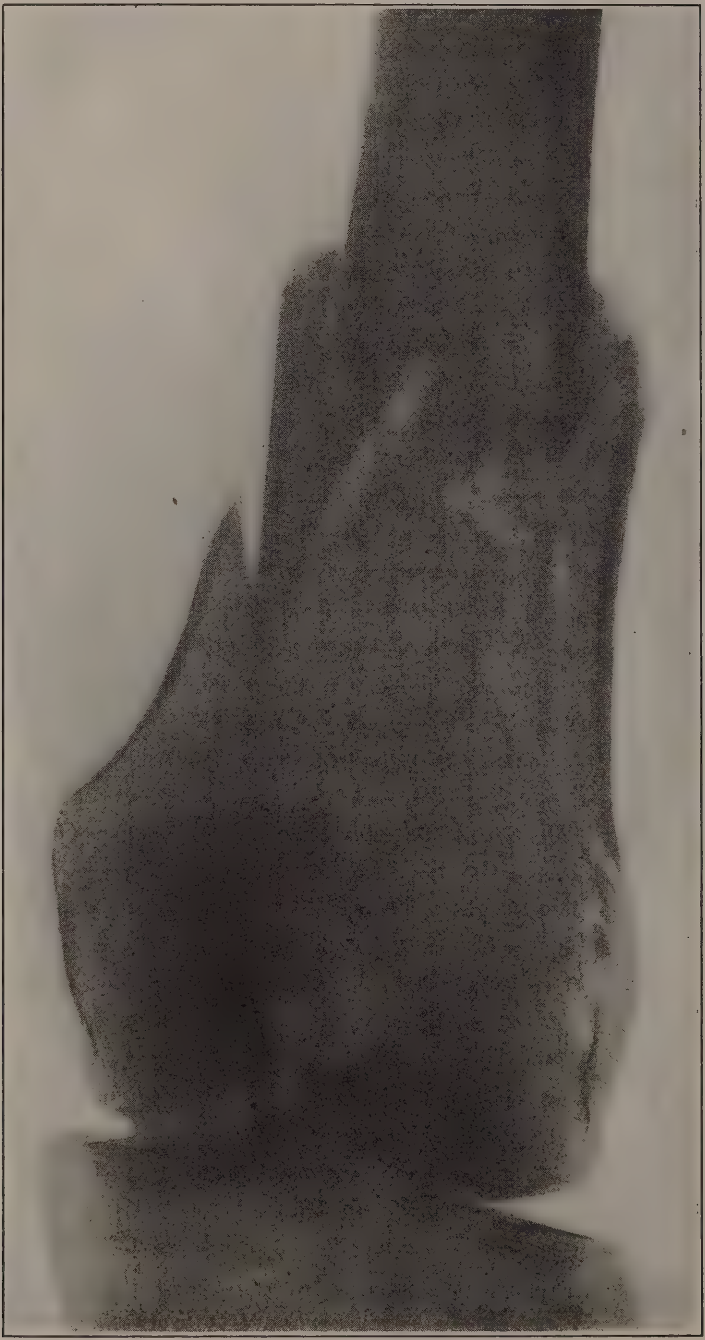


PLATE NO. 3 A
Front view of fracture shown in Plate No. 3

The patient is well satisfied with the results, and has been instructed in a series of exercises which will undoubtedly bring further improvement during the next year.

COMMENT

Simple comminuted fractures of this severity rarely occur. They are usually of the compound type with its concurrent infection. Eisendrath and Straus* state that transverse fractures of the patella should be operated early, and that a suture of the periosteo-aponeurotic covering with absorbable material is all that is necessary. On account of the extensive major fractures, we considered immediate operation on the patella inadvisable. When the operation was done, wiring was considered safer than suturing with kangaroo tendon or chromic catgut, owing to the tension required to hold the fragments in place. We think the end results justified our decision. An early open operation done with nailing and wiring might have given better anatomical and functional results, but the danger of infection and, later, of non-union had to be considered.

THE MACHETE VERSUS THE MICROBE IN CENTRAL AMERICA

ALFRED GAGE, M.D.
Quirigua Hospital, Guatemala

This paper deals with the Central American natives, the "peons" or "mozos" from the low country.

For over five years I have been more or less closely associated with these people in their huts and camps, and in the hospitals. They present many interesting and instructive features, and it is with the hope of stimulating interest in such a prolific clinical field that a few remarks on two conditions frequently encountered are offered for consideration:

First, their low resistance to, and comparatively high mortality from, acute infections and contagious diseases—especially pneumonia.

Second, their remarkable resistance to the terrific wounds from firearms, cutting and piercing instruments, etc.

Some years ago my attention was first drawn to these characteristics of the native mozo, and subsequent constant observations have confirmed my first impressions.

In Spanish Honduras we experienced two very severe epidemics, viz: (a) Influenza, with its high percentage of pneumonia, and (b) A type of bacillary dysentery of extreme virulence.

In addition, as a result of revolutions occurring in the country about that time, we had ample opportunity to observe a great many wounds of varying degrees of severity before, during, and after these epidemics. In many cases of pneumonia, etc., the mozo died when an Anglo-Saxon would probably have survived, while in many instances the natives bore with impunity terrific wounds, to which an individual of the other race would have succumbed rapidly, if not immediately.

---

* "Fractures," Eisendrath, D. N., and Straus, D. C., in "Keen's Surgery," Vol. VII, Chap. XVI, 1921, (p. 440)

We must bear in mind that (a) the vast majority of the wounds are caused by the machete, a razor-sharp, well-balanced knife, two or three feet long, without which no mozo feels completely dressed (with this knife he can pare an orange or cut down a tree), and (b), to control haemorrhage the wounds, as a rule, are packed with the nearest available substance, i.e., ground leather, grass, coffee grounds, crude oil, lime and salt, rags, leaves, etc. Such treatment naturally predisposes the wound to infection, and yet even under these circumstances many patients with multiple wounds recover, showing no physical defects.

A few words regarding their reaction to some of the acute infections and contagious diseases may not be amiss here:

(*A*) *Measles.* — While the mortality from this disease is quite low, the patients as a rule are very sick for a few days. The eyes are intensely congested; there is marked photophobia, usually accompanied by a sero-purulent exudate; the temperature is very high for several days; the rash is general and most profuse. There is a severe laryngitis, with complete aphonia in many cases, and always a violent bronchitis which, if not carefully watched, frequently develops into a terminal pneumonia. The scaling which follows the rash is much more extensive than in the case of the American or the northern European. In other words, every symptom is more acute than in the average case in the United States.

(*B*) *Influenza.* — The manifestations of this disease are about the same as those occurring in the United States, but the incidence of pneumonia as a complication is distinctly higher. For the past two years, the mortality has been very low in comparison with that of an earlier period. I believe this was due to the fact that the cases were caused by a strain of the organism low in virulence, rather than being the result of a relative immunity or a higher resistance developed by the natives themselves. During the influenza epidemic of 1922, the percentage of pneumonia as a complication was very high; and the mortality, of course, was terrific.

(*C*) *Pneumonia.* — This disease, I believe, is responsible for more deaths than any other; and even more than several others combined. The mozos' resistance to both the broncho and lobar types seems to be less than they show for almost any other disease. In Table A (page 212), it is shown that 20.88 per cent of all the hospital deaths were caused by lobar pneumonia, and 6.51 per cent by broncho-pneumonia; while Table B (page 212) records that the combined percentage of deaths from broncho and lobar pneumonia in relation to the hospital cases of pneumonia (i.e., the fatality rate) was 33.96.

(*D*) *Bacillary Dysentery.* — In Spanish Honduras several years ago we experienced the worst epidemic I have ever seen. The disease was of extreme virulence—the great majority of the patients being highly toxic from the outset; and the mortality was very high. It was by no means uncommon for a patient to have seventy-five or a hundred stools daily, virtually living on the bedpan or commode, passing small amounts of blood, pus, and mucus. Although cultures and agglutinations were positive for the Flexner type of B. dysenteriae, I do not believe that this epidemic was caused solely by either the Shiga or the Flexner bacillus, but am of the opinion that it was attributable to some other organism, of extraordinary virulence, probably engrafted upon a true bacillary dysentery. The patients who showed the highest toxicity rapidly succumbed. In a very few days, an individual would literally waste away to "skin and bones." The mozos and Miskito Indians seemed to have practically no resistance to the infection, which was confined almost exclusively to them. The incidence of post-dysenteric arthritis was very low; in the few cases showing large amounts of sero-purulent effusion the knee joint was almost exclusively involved.

There are several factors besides the actual disease *per se*, which influence the mortality rate among these people.

(1) *History.* — Many of the patients are admitted with the disease in an advanced stage—e.g. pneumonia of one or both lungs. Generally they have tried various home remedies for several days, strong purgatives being their favorite medicament. In these cases the disease has made considerable progress before a doctor is consulted, and the patient is weak and dehydrated from the severe purgation.

(2) *Malnutrition.* — The majority of the patients are poorly nourished. Their diet consists almost exclusively of boiled rice, beans, tortillas; meat occasionally, and fruit if easily available. They drink large quantities of the high-powered native rum at frequent intervals, and when drunk fall down and sleep anywhere in any kind of weather.

(3) *Complications.* — An extremely high percentage of the native population suffer from acute and chronic malaria and various intestinal parasites.

(4) *Heart.* — As a result of their diet, mode of living, chronic malaria, and intestinal parasites, they have a rather poor myocardium; and many have murmurs at all valvular areas, due, to a large extent, to the anaemia present. In most acute infections, their hearts are affected early in the course of the disease, and require appropriate stimulation.

(5) *Hospitalization.* — It is with considerable difficulty that the average patient is prevailed upon to stay in bed. They all use a bedpan by squatting over it in the center of the bed until actually too weak to rise. Moreover, they insist on sitting up in bed at every opportunity, regardless of a backrest; and, unless the physical pain and weakness are too great, they will get out of bed and attempt to walk, in the belief that the exercise will enable them to gain strength. This is true during both the acute and the convalescent stages.

Bearing in mind the law of pathology, that the severity of the infection depends upon the virulence of the organism and the resistance of the host, I have offered these few statements in an endeavor to explain the low resistance of the native, and to call attention to a few of the contributing factors responsible for the high death rate recorded for some of the more common microbial diseases.

WOUNDS FROM THE MACHETE

The way in which the mozos recover from some of these wounds is, to me, little short of the miraculous.

Their resistance to all types of wounds is high, with the noticeable exception of those in and about the knee joint. In this area the percentage of purulent arthritis is very high, and the extension of the infection upward and downward is extremely common, and usually rapid. Small and apparently superficial wounds about the patella, especially along the lateral borders, often lead to a terrific infection of the knee joint. This may be partially explained by the fact that natives, as a rule, pay little attention to small wounds, and frequently wait until the knee is swollen and painful before reporting for treatment. However, an arthritis is by no means always prevented, even when such a wound is carefully dressed in the hospital shortly after it is inflicted. Another factor is the edge of the machete, which is very thin and keen. The wound may appear superficial even when the razor edge has actually cut through the joint capsule. Aside from this explanation, the fact remains that small and apparently superficial wounds about the knee are frequently followed by a severe infection of the joint, necessitating incision and drainage.

During the past five years machete wounds have been observed on practically every part of the body, from the head to the toes, and including the more important thoracic and abdominal viscera. Gunshot wounds are similar in distribution but much less frequently encountered. Injuries of the head and upper extremities are the most common, the machete being the weapon of choice.

Wounds of the head may be roughly divided into two groups:

Group 1. — A blow with the machete at an oblique angle. It either cuts away the entire portion involved or, usually, it results in forming a kind of osteoplastic flap with the pedicle generally downward. This flap may consist only of the tissues of the scalp, but more frequently includes the outer table or both tables of the skull, and brain injury may or may not be included. The percentage of multiple wounds is higher than that of single wounds. They may involve an area ranging in size from only two inches in diameter to an area comprising almost the entire lateral, frontal, or occipital portions of the cranium. This type of wound as a rule gives little trouble, usually healing by first intention even though previously packed with various harmful substances by the patient or his friends, to control haemorrhage. Meningitis is rare, unless the dura has been severely injured.

Group 2. — In this case the machete is held more or less at right angles to the skull; the wounds may be on any part of the head. These wounds are the more dangerous, for in many instances it is impossible to decide whether or not the brain has been injured. Because of the narrowness of the cut made by the sharp edge of the machete, there is no probe or flat instrument which can be passed through the skull wound, unless one side of the wound has been elevated by a twist of the machete after striking. While many of these wounds appear superficial, they really extend into the brain, which may show extensive maceration. It is by no means uncommon, after an opening has been made through the skull, to find macerated brain tissue welling up under varying degrees of pressure. Wounds of this character, from one to several inches in length, have been observed to involve, in different patients, almost every portion of the cerebral cortex; yet a number of these persons have recovered. More remarkable than their recovery, however, is the fact that many of the patients after recovery have shown little or no disturbances of gait, motion, or speech, although at times the wounds have apparently involved the areas which control these functions. This is also true of Group 1.

The deaths, when they occur, are generally due to meningitis, as would be expected.

Unfortunately statistics showing the comparative death percentages from various wounds are not available; but penetrating wounds of the abdomen rank first, and of the head second.

The majority of chest wounds involving the lungs are caused by bullets, and do not give much trouble, healing, as a rule, without operative interference.

Wounds of the upper extremities vary from superficial scratches to complete, clean amputations. In this region of the body they are more often multiple.

Machete wounds of the trunk vary from one to fourteen or sixteen inches in length, and from slight cuts on the skin to perforation of the thoracic or abdominal organs. They may be linear incisions, huge pedicled flaps, or complete evulsions of tissue. Most of these wounds heal quickly with little, if any, infection.

I have no definite explanation of the apparently abnormal power of the natives to recover rapidly from wounds which would ordinarily prove fatal, leave severe after effects, or necessitate a long period of convalescence. There are, however, two factors which may offer at least partial explanation. I refer, first, to the low degree of shock which is generally present, ordinarily far less than in the average European who has suffered the same degree of injury. It seems to be an established fact that the nervous systems and receptive centers of these people are not stimulated by wounds to the same extent as those of the average Anglo-Saxon. Another important factor is their usual condition at the time of injury. Most of the machete wounds are received during a drunken brawl; the majority of the patients arrive at the hospital intoxicated, and some even in a state of coma. I have coined the phrase, *alcoholic anaesthesia*, for such a condition, as it is by no means uncommon for a patient to have received multiple wounds, of which he is first aware several hours after the injuries are inflicted. It is frequently impossible for him to recall any of the happenings.

When a patient arrives in such a state it is quite possible to dress, or even to suture, several wounds without anaesthetizing, and the only evidences of pain are an incoherent muttering, low cries, and a tendency to be restless. This is not true of all cases, however, as some of the natives are not intoxicated when wounded. Unless the patient is in a serious condition from great loss of blood, the ordinary clinical manifestations of traumatic shock are usually not very severe, although they may be present to some extent.

The recovery of such patients, irrespective of the period of convalescence, is to me a constant source of wonder and satisfaction, considering their general physical condition, the character and number of wounds in a single individual, their methods of treatment (i.e., home remedies), and the loss of blood in persons already anaemic.

The following brief description of seven cases having multiple wounds is given to show the types of wounds which these people often survive.

CASE REPORTS

I

J. P. — Carib; male; adult; Guatemalan; machete wounds.

(1) 4-inch incised wound down to m. transversalis, lateral portion of left abdomen, extending obliquely upward from nipple line to mid-axillary line.

(2) Incised wound, curved, about 8 inches long, from under outer third of right clavicle, towards sternum, to level of nipple. Incision exposing ribs; not entering chest cavity.

(3) 4-inch incised wound from superior portion of right scapula, at which place the scapula was completely divided, extending downward and inward, exposing bone.

(4) 6-inch incised wound beginning at right mastoid process, and extending along margin of inferior maxilla to midline of chin, through muscles and parotid gland, cutting away a portion of the maxilla near chin. Upward pressure of the finger through the wound would cause floor of the mouth to bulge upward.

(5) 3-inch incised wound vertically across forehead, 1 inch to left of midline from hair line to supra-orbital ridge; exposing and slightly injuring outer table of skull.

(6) 6-inch incised wound beginning behind and above left ear, curving downward to maxillary sinus. Middle ear exposed, and portion of the roof from left maxillary sinus cut away.

(7) 2-inch incised wound, through muscles, across inner portion of head of left humerus.

(8) 3-inch incised wound into muscles, ulnar side of left arm, ranging downward across elbow; no joint injury.

(9) 2-inch incised wound into muscles of mid-portion of left forearm.

All of these wounds healed by first intention and convalescence was uninterrupted, except in the cases of Nos. 2 and 6, which showed a mild infection of staphylococci. At the time of discharge, the patient, in spite of everything, only had a slight facial paralysis and was partially deaf in the left ear. The wounds were about 12 hours old when he was admitted to the hospital for treatment.

II

R. Z. — Nicaraguan, age 21.

(1) 5-inch incised wound over vertex, through outer table of skull.

(2) Incised wound began through pinna of right ear; extended through side of face, cutting through skin and underlying muscles (buccinator, masseter), opening lower portion of the maxillary sinus, severing the parotid gland, and cutting through inferior portion of nasal septum; wound gaping about 2 inches.

This wound was closed by subcuticular suture. Recovery was uneventful, with no infection. The patient was discharged, with slight right facial paralysis.

III

Z. O. — Honduranian; age 7.

1-inch stab wound, level of umbilicus to the left of the midline, penetrating abdomen. Two small perforations of the ilium. Peritonitis was well marked; free pus in the cavity, with portions of the gut adherent by plastic exudates.

One drain used. Recovery was rapid and uneventful.

IV

B. H. — Nicaraguan; adult.

(1) Entire right side of face cut off, except a 1-inch pedicle behind ear, and a 1-inch pedicle over mid-portion of sterno-mastoid muscle. This wound severed right ear and cheek, extending downward below border of inferior maxilla. When the original bandage was removed, the entire flap fell down on the shoulder, being attached only by the two small pedicles.

(2) 3-inch incised wound below middle third of right clavicle, forming a flap, pedicle downward.

Recovery was uneventful, except for slight sloughing of the skin edges of the face wound. Healing was by first intention.

V

C. C. — Honduranian; male; adult; gunshot (revolver) wounds.

(1) 2 inches above and 1 inch lateral to left nipple.
(2) Edge of sternum (left), between 2nd and 3rd ribs.
(3) 2 wounds, 1 inch apart and 2 inches above right nipple.
(4) Inner surface, middle third, right arm.
(5) 2 wounds, 4 inches apart, 6 inches above left knee, medial surface of thigh.
(6) 6 inches below right great trochanter, outer aspect of thigh.
(7) 1-inch wound to the right of vertebral column, between 3rd and 4th dorsal segments.

All bullets striking the chest penetrated the lungs.

Steady and rapid convalescence occurred, without complications. Patient was discharged, cured; no operative interference, except extraction of one bullet under the angle of right scapula.

VI

J. G. — Guatemalan; male; adult.

(1) 1-inch incised wound (machete), medial border of right patella, occurring 5 days previous to admission to the hospital.

The knee was tremendously swollen. The inflammatory process extended 6 inches up the thigh, and downward to the middle third of leg. The joint cavity was filled with sero-purulent effusion, and the patient was quite septic. An immediate operation was performed and convalescence was very slow. He was discharged, cured.

VII

J. S. — Honduranian; male; adult; gunshot.

Stellate depressed fracture immediately above occipital protuberance; bullet in skull. When the depressed fragments were removed, about 2 ounces of blood clot and macerated brain tissue emerged, under pressure, from the wound.

A cavity in the brain about the size of a good-sized lime was explored with the finger.

The scalp wound was closed with drainage.

Recovery was steady and uneventful. Patient was discharged, cured. No physical defects in gait or otherwise.

No explanation is needed for the appended tables, abstracted from the 1925 Annual Report of the Medical Department of the United Fruit Company, showing the mortality and fatality rates for pneumonia and external violence, respectively, (including all forms of injury: wounds, crushing injuries, falls, etc.):—

TABLE A

CAUSE OF DEATH ACCORDING TO PERCENTAGE OF FREQUENCY

(Deaths in U. F. Co. Hospitals)

(From p. 23)	1924	1925
Total Respiratory Diseases	28.77	28.54
Broncho-pneumonia	8.61	6.51
Lobar and Undefined Pneumonia	18.56	20.88
Total External Causes, Wounds, etc.	11.10	7.56

TABLE B

RATIO OF DEATHS TO HOSPITAL CASES

(Per Cent)

(From p. 27)	1925	1924	1923
Pneumonia, Broncho- and Lobar	33.96	35.53	36.20
External Causes, Wounds, etc.	2.18	3.64	3.00

TABLE C

CLASSIFICATION OF DISEASES TREATED IN HOSPITALS—DEATHS IN HOSPITALS—1925

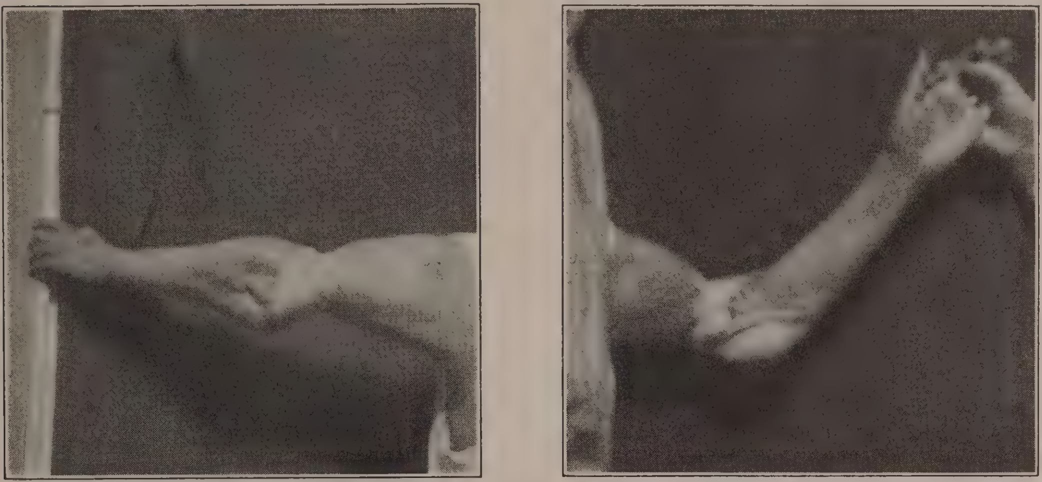
(From p. 75)	Cases	Deaths
Total Broncho-pneumonia	213	59
Total Lobar Pneumonia	570	206
(From p. 81)		
Total Injury by Firearms	145	16
Total Injury by Cutting or Piercing Instruments	1,235	8

A CASE REPORT—ANNULAR CALCIFIED SCAR

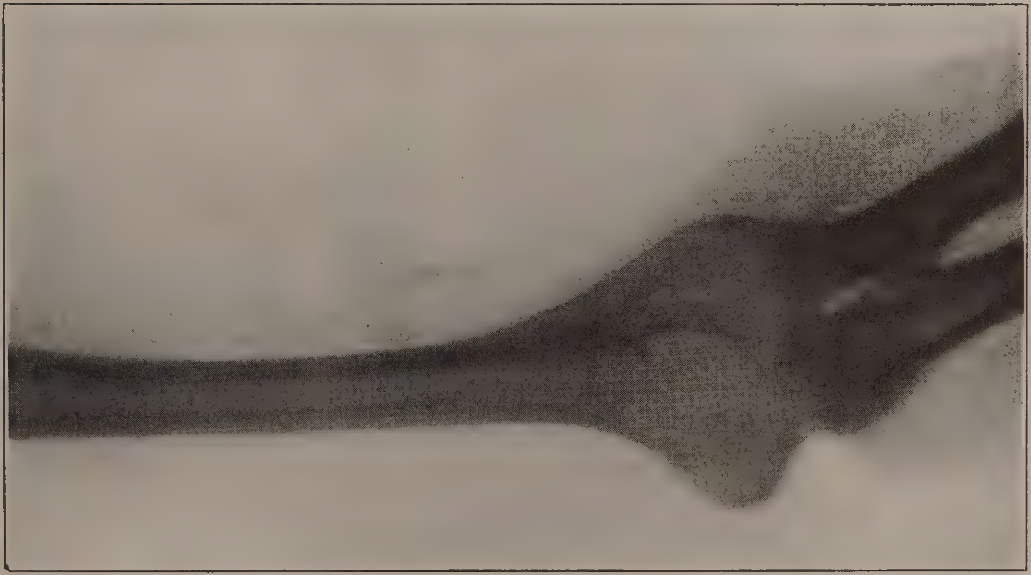
R. B. NUTTER, M.D.

Tela Railroad Company Hospital, Tela, Honduras

The photograph and radiograph shown below illustrate an unusual and interesting case of an annular calcified scar above the elbow, causing deformity and disturbance of the circulation of the upper arm. The injury occurred



PHOTOGRAPHS OF ANNULAR CALCIFIED SCAR



RADIOGRAPH OF THE ARM

twenty-five years ago, when the patient was nine years of age—a burn of the arm and forearm, caused by a candle igniting the clothing. The disturbance of the circulation in the forearm began one year ago, and was accompanied by the development of areas of tenderness in the scar, where three sinuses developed, caused by erosion through the surface over the calcification. Three calcareous masses with deep blue pigmentation were excised, and the constriction was released by incisions which relieved the symptoms. The pigmentation undoubtedly was the result of ink, which was applied as first-aid dressing at the time of the burn.

A SUPPLEMENT TO LAST YEAR'S REPORT ON THE TREATMENT OF WOUNDS POST-OPERATIVELY WITHOUT DRESSINGS

I. E. PEON, M.D.
Almirante Hospital, Panama

Supplementing my last year's report, I desire to emphasize my remarks regarding the employment of the hair-drying apparatus instead of dressings on the wounds of clean surgical operations.

During the year, the operative wounds on 26 laparotomies and 18 herniotomies were handled in this manner with exceedingly satisfactory results. In all cases interrupted sutures were used in closing the wounds. In only 2 cases a single stitch abscess developed, which delayed their discharge from the hospital 2 and 4 days, respectively.

In 3 cases, a single stitch was removed to allow the escape of a small accumulation of serum, but this did not delay the patients' convalescence.

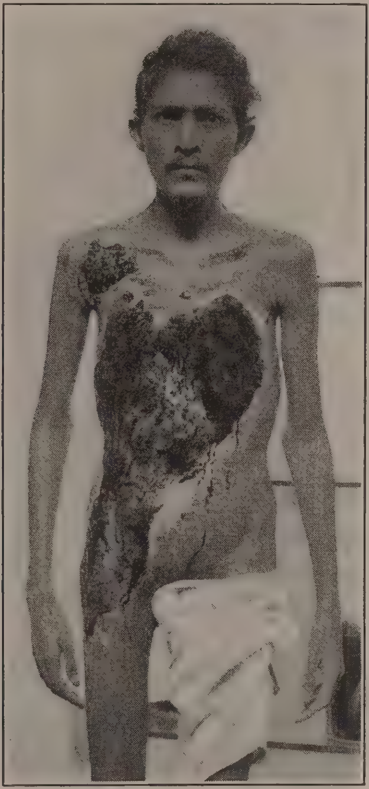
Wounds treated post-operatively by this method can be inspected each day and any infection can be detected early, without having our attention called to it by the temperature chart, which is often the case when infection occurs in wounds that have dressings on them.

A BRIEF DESCRIPTION OF AN EXTENSIVE INJURY, WITH RECOVERY, AND A SIMPLE AND SATISFACTORY METHOD OF TREATING SKIN GRAFTS

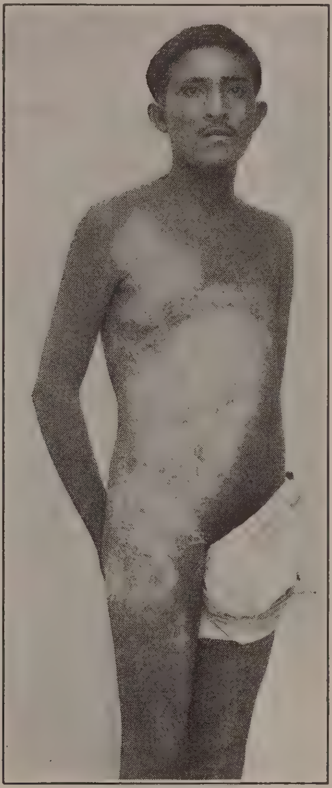
R. B. NUTTER, M.D.
Tela Railroad Company Hospital, Tela, Honduras

Case No. 4816.—A Salvadorian laborer, age 23, was admitted to Tela Hospital May 7, 1926, 4 hours after being injured by falling into the gears of a pump which was draining a flooded steam-shovel pit.

The skin and fat were torn from the anterior chest, the abdominal wall, and the anterior surface of the right thigh to a point 6 inches below the right trochanter. The wound extended, on the right, from the shoulder joint and 1½ inches above the clavicle to the posterior-axillary line; on the left, from the 3rd rib to the anterior-axillary line and down to 1½ inches above the anterior-superior spine of the ilium. There was a defect of the entire abdominal wall, 4 inches in diameter, in the epigastric region through which protruded a part of the stomach, the omentum, and several loops of the small intestine. Right 6th, 7th, and 8th costal cartilages and tips of the ribs were torn out.



PHOTOGRAPH NO. 1



PHOTOGRAPH NO. 2

A pad of cotton with 1 to 2,000 solution of bichloride of mercury and a bandage had been applied over the protruding intestines, but there was no dressing on the rest of the wound.

The photograph of November 11th (Photograph No. 1, above) shows the amount of flaps salvaged—a strip across the right pectoral muscles and 1 to 3 inches along the left margin of the wound. An attempt at grafting seemed indicated, to prevent deformity from contracture in the right groin, although there was still sufficient secretion to float grafts applied and dressed according to usual methods. After the first thorough application of 2% mercurochrome, when the patient was admitted, wet dressings of 5% salt solution were used.

There was no preparation of the surface to be covered. Grafts of varying size and thickness were applied; thick pinch grafts were imbedded in the granulations, and large Thiersch grafts were pressed on the surface. A single layer of wide-mesh gauze was stretched over the wound, moistened with 5% salt solution, but no other dressing was applied. A cradle containing a 50-watt electric bulb was put over the patient and covered with a sheet.

The grafts were kept wet with salt solution applied every 2 hours, excessive secretion was gently sponged away twice daily, and the gauze was not disturbed for 5 days. After 2 weeks the patient was sent to the beach and gradually exposed to sunlight until his normal skin was well tanned.

Proliferation from the grafts was very rapid.

The final result is shown in the second photograph, made March 26, 1927 (Photograph No. 2, page 215.)

REMOVAL OF CRANIAL EXOSTOSIS FOR EPILEPSY

E. W. Davis, M.D.

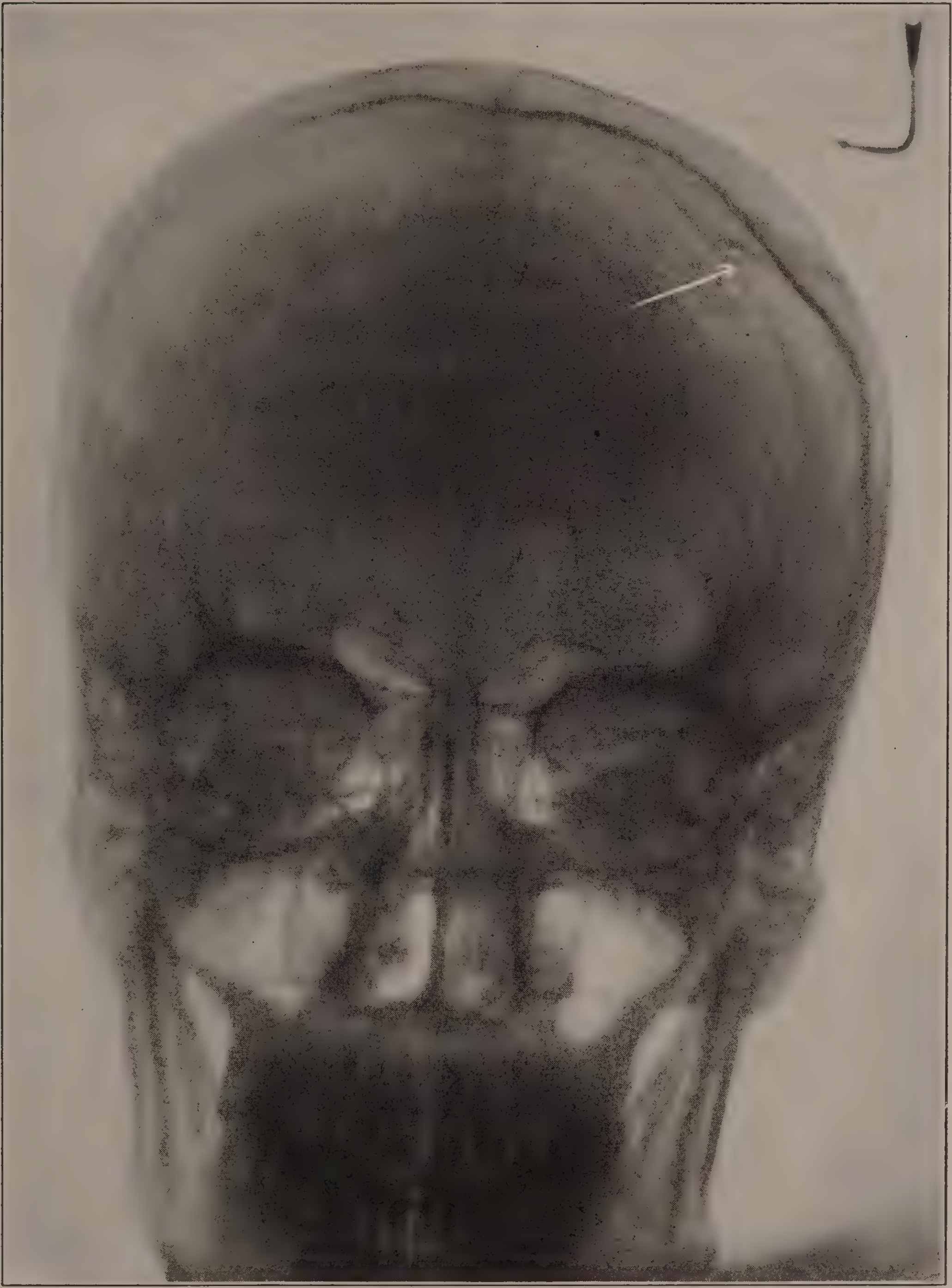
Truxillo Railroad Company Hospital
Puerto Castilla, Honduras

Report of Case

E. T., Case No. 20,006, negro, male, age 22 years. Admitted to Puerto Castilla Hospital May 4, 1926, with chief complaint—Fits.

Past History. — He was born on Roatan Island, off the coast of Spanish Honduras. Has a congenital deformity of the left foot. He had always been perfectly healthy, and had worked continuously up to two years ago, when he was struck over the left occipito-parietal region with a boat paddle. Although he was knocked down, he did not lose consciousness, but for about 2 hours after receiving the blow he was unable to speak. There was no nausea nor vomiting, no haemorrhage from nose, ears, or mouth, and no involuntary defecation or urination. He was seen and treated by a doctor outside of the hospital. The wound healed slowly, but was well in 6 weeks. Although he was completely aphasic for only 2 hours, there was some interference for a week, his speech gradually returning to normal.

Present Illness. — About 5 months ago he had a convulsion, typically epileptic in character. He had no premonition, such as tingling of fingers, ringing of ears, etc., and no involuntary urination or defecation during the attack. Similar attacks continued to occur at irregular intervals, about 18 to 20 times a month. The exact duration of unconsciousness is not known, but immediately after an attack he would feel very weak, almost in a state of collapse. This condition would be followed by an intense headache lasting about 1½ hours. The convulsions have become more violent and more frequent. He has been to the



X-RAY OF SKULL

dispensary several times and received medicine, but without relief. The deformed foot has never given him any trouble, and there are no other associated disturbances. The gastro-intestinal, cardio-respiratory, and genito-urinary systems are negative. The family history is irrelevant.

Physical Examination. — An apparently healthy, well-developed, and well-nourished negro man.

Head. — Over the left occipito-parietal region there is a healed oblique scar, 2½ inches long, extending downward and forward. There is a very definite depression in the center of the scar, but apparently no adhesion of the cicatrix to the bone.

Teeth. — A few carious teeth in need of dental work, but not extraction.

Heart. — Normal; blood pressure, S. 119, D. 74.

Left Leg. — Marked diminution in size of thigh and leg. All groups of muscles equally involved. Sensation not disturbed. Foot is completely flat and everted. Motion of hip, knee, and ankle, however, is normal.

Temperature, Pulse, and Respiration. — Normal.

Physical examination otherwise shows no pathology.

X-ray of Skull shows what is apparently a spur of bone protruding from the inner table of the left occipito-parietal region, downward toward the brain, for a distance of ⅜ or ½ an inch. (Note this on X-ray picture, page 217.)

Laboratory Report. — *Urine:* Normal
Blood: Meinicke negative. Thick and thin films negative for malaria.
Stools: Ova of uncinaria and trichocephalus

Diagnosis, — Epilepsy due to cranial exostosis.

Operation. — May 5, 1926. This was done under ether anaesthesia and began at 9.20 A.M.

Skin Incisions. — Large horseshoe-shaped skin flap turned downward. Bone was exposed and ½ inch trephined. A crushing rongeur forcep was used and a piece of bone, elliptical in shape, 2 inches long and 1 inch wide, was removed, which took in all the depressed area. The piece of bone was densely adherent to the dura and separated with some slight difficulty, but without bleeding. From the center of the old fracture there was a spur of bone with a large base and smooth point, about ³/₈ of an inch long, which pressed down into the brain tissue. The brain in this particular region was much softer than normal. The dura was not opened.

Closure. — Fascia, No. 1 Chromic. Skin, silkworm gut.

Operation Concluded at 10:40 A.M.

Progress Notes:

5/5/26, 8 P.M. Temperature 102.4 F., pulse 128 regular, good volume. Reacted promptly from anaesthetic, with very little nausea and vomiting. General condition good.

5/6/26, 9 A.M. Had light convulsion; was unconscious for 1½ minutes. Temperature 101.6 F., pulse 100. Condition good.

5/9/26. Temperature, pulse, and respiration normal. No complaint.

5/12/26. Had light attack at 9 A.M., which lasted about 1½ minutes, but he feels no ill effect after the attack. Temperature, pulse, and respiration normal.

5/15/26. Sutures removed. Wound is healed. There is no evidence of infection. The patient is sitting up in chair, feeling well, and has no complaint.

5/21/26. Discharged from hospital, with the request that he return if any convulsion occurs.

Follow-up Notes:

On August 7, 1926, he had a convulsion, came to the dispensary, and was given Luminal. This was the first convulsion he has had since discharge from the hospital, and he says it was the lightest one he has ever had.

On December 22, 1926, the patient states that he is working every day, and feels much better. He has had only 6 convulsions since his discharge from the hospital, and each time the attack was lighter than the preceding one.

A CASE REPORT—BILATERAL TUBAL PREGNANCY

L. M. DRENNAN, M.D.

Santa Marta Hospital, Colombia

Female, Colombian, age 33, married, housewife.

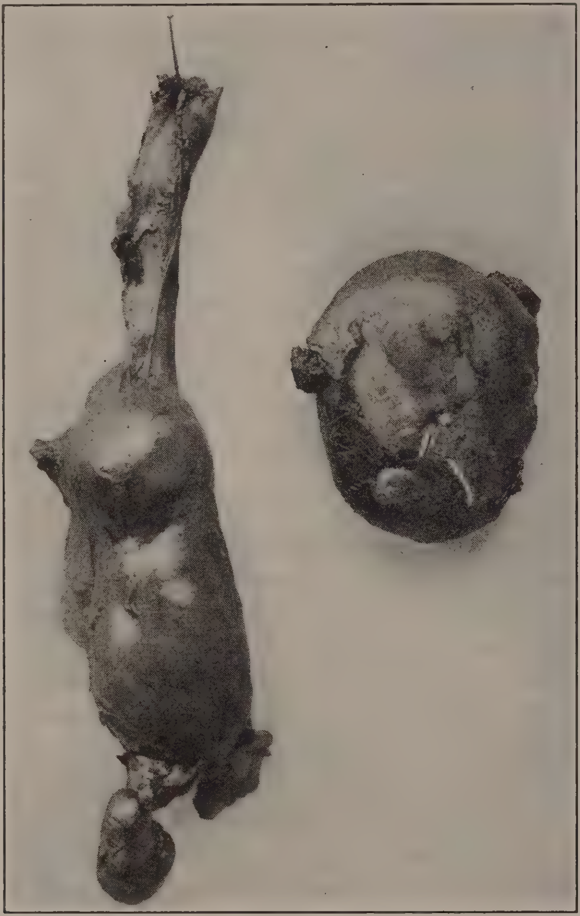
Past History. — Except for the usual fevers and bowel complaints common in the coastal region of Colombia, has always had fair health, and is the mother of three children born at term.

Present Illness. — For the past six weeks, has been having irregular, and at times profuse, menstrual flow accompanied by cramp-like pains in lower abdomen, especially on the right side. Periods had been regular up to that time. She has been taking, without relief, the usual remedies prescribed for this trouble.

Physical Examination. — Patient is a rather tall, fairly well-nourished native Colombian woman. Nothing abnormal was revealed in an examination of the chest and upper abdomen, but there was tenderness on deep pressure over the region of the appendix, without causing spasm of rectus muscle. No fever. The blood was negative for malaria; Wassermann reaction also negative. Haemoglobin 85. Urinalysis negative. The stool contained ova of uncinaria and amoeba coli cysts.

Pelvic examination revealed a slight relaxation of the vaginal outlet and a lacerated cervix. The uterus was retroverted and tender. Both vaginal vaults were also tender, especially the right, with seeming induration high up. The tenderness was too pronounced to admit of more thorough examination from that standpoint. Operation was advised, and submitted to a few days later.

Operation. — The following conditions were found: The right tube, at the fimbriated end, was markedly enlarged into a rounded mass the size of a fairly large lime, and was of a dark, bluish-red color. Along with the corresponding ovary, it was adherent to the small intestine and the lateral wall of the pelvic cavity high up. The left tube revealed a sausage-shaped irregular swelling throughout almost its entire extent, surrounded by plastic adhesions to the ovary and the pelvic peritoneum on that side. The color was similar to that of the other side, but the tube was of softer consistency and, on removal, exuded a dark meconium-looking substance. The uterus was retroverted and held down by plastic adhesions, none of which showed any infective or inflammatory signs of an acute pelvic disease. There was very little, if any, free or clotted blood encountered in the pelvic cavity.



PHOTOGRAPH OF THE TWO MASSES REMOVED AT OPERATION
(Tubal Pregnancy)

Both tumors were removed, and the uterus was suspended by the usual round ligament method. The appendix was found kinked and adherent, and was removed; its condition might have accounted in part for her right lower iliac tenderness. The abdomen was closed in the usual manner, without drainage. The woman made a rapid and uneventful recovery, and was discharged from the hospital on the 13th day following operation.

The accompanying illustration is a photograph of the two masses removed. A diagnosis of double tubal pregnancy was made at the time of operation. This diagnosis was confirmed by the following pathological report on one tube, made by Dr. F. B. Mallory, of Boston City Hospital, Boston, Mass.

> Microscopic examination shows well-marked chronic salpingitis, also extensive haemorrhage into the tube, with chorionic villi present in it. In the wall there is considerable hematoidin and hemosiderin pigment present.
>
> Diagnosis: Tubal pregnancy.
>
> F. B. MALLORY

This case is of interest and is reported because of the rather uncommon occurrence of a bilateral tubal pregnancy. Fortunately for the patient, the progress of the pregnancy had ceased before the development of untoward symptoms due to haemorrhage from rupture. The findings at operation accounted easily for her pain and menorrhagic symptoms. The absolute denial of cessation of menstrual periods at any time was one of the interesting features of this case.

A CASE REPORT—SEVERE SECONDARY ANAEMIA TREATED BY BLOOD TRANSFUSION

R. B. NUTTER, M.D.

Tela Railroad Company Hospital, Tela, Honduras

Case No. 5,141. — Female Honduranian, age 27, married, primipara, admitted June 14, 1926.

History. — April 18, 1926, normal delivery, with moderate haemorrhage. Since delivery she has had fever, weakness, anorexia, cough, insomnia, increasing dyspnoea, and oedema of the face, hands, and legs. No chills, no pain. She was treated with iron, arsenic, sodium cacodylate, salvarsan, and quinine.

Examination. — Pallid, prostrated; oedema of the hands, legs, and face; emaciated; muscles atonic; heart dilated; liver enlarged (lower border 2 inches below costal margin); tip of spleen below umbilicus; moderate ascites; lacerated perineum and cervix; moderate purulent vaginal discharge.

Temperature, 101° F.; *pulse,* 130, poor quality but regular; *blood* E.A. (thick film, 2 parasites seen), leucocytes, 5,800, reds 740,000, haemoglobin 10%; *Kahn test,* negative.

Urine, faint trace albumin, pus (voided specimen)

Stool, uncinaria, cysts *E. coli*

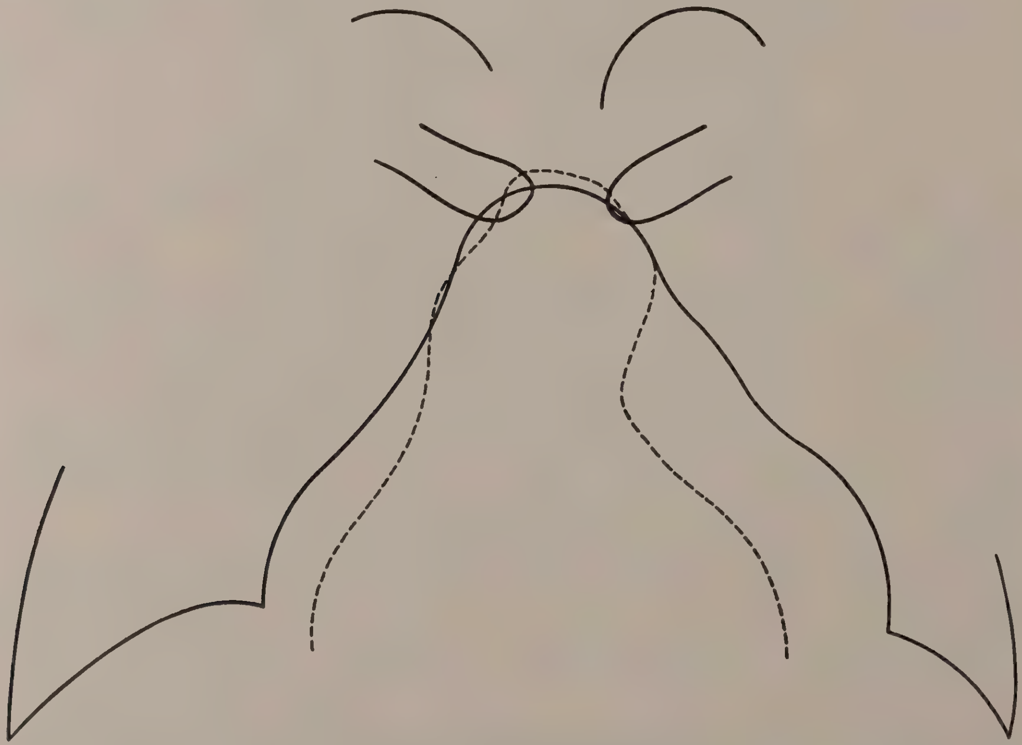
Fluoroscopic Examination. — Heart enlarged in all dimensions. After symptomatic treatment for 4 days, during which time the patient's general condition grew progressively worse, blood transfusion 250 cc. was performed. This was followed by chill, vomiting, and severe pain in the chest; fever 103° F.; pulse 140. The patient recovered from the reaction in about 6 hours.

Medication.—Tr. digitalis m. x b.i.d., Basham's mixture dr. IV b.i.d., sodium cacodylate gr. 1½ every 2 days. Her general condition improved rapidly. She left the hospital July 20th, because she felt entirely well. Appetite was good, and she was rapidly gaining weight. The oedema had disappeared; heart appeared normal; liver was reduced to its normal size; and the spleen extended only ½ inch below costal margin.

The haemoglobin estimate on June 19th, before transfusion, was 10%. After transfusion, the estimates were: June 21st, 25%; June 26th, 20%; July 1st, 18%; July 7th, 25%; July 14th, 40%; and July 20th, 55%.

The composite of two orthodiagrams made by Dr. Sylvia Berg on July 5th and July 20th, respectively, showed the changes in the size of the heart during that interval—a reduction of the greatest diameter from 6½ to 4⅞ inches (see illustration, below).

Because of the results obtained in this case of blood transfusion from a healthy donor, we consider the further use of this treatment warranted in some of our cases of grave anaemia. We did not consider the uncinaria infection an important factor, and therefore gave no treatment for it.



COMPOSITE OF TWO ORTHODIAGRAMS

SPINAL ANAESTHESIA

JAIME DE LA GUARDIA, M.D.
Preston Hospital, Cuba

> "Les intestines sont retracté, "figes" la paroi abdominale est souple, le silence abdominal est parfait."
> VICTOR PAUCHET

Reviewing the recent surgical literature on spinal anaesthesia, I have been impressed with one outstanding fact, namely, that the reports come from large clinics where permanent trained anaesthetists, numerous surgical teams, and large nursing personnel are available, and where the need for a rapid, easily administered, and efficient anaesthetic is important but not essential to the harmony of a well-run operating room. These reports have shown conclusively the advantages of this method of producing anaesthesia, but I feel sure that they have not helped as they should to popularize it among the busy surgeons of the small hospitals, where its advantages are paramount.

To the busy surgeon of the small hospital, who has no trained anaesthetist, no regular surgical staff, and only a limited nursing personnel, this article is dedicated.

A brief history of spinal anaesthesia will show that in 1835 Dr. J. Leonard Corning, experimenting first with dogs and later with human beings, and using a solution of 2% cocaine, produced anaesthesia by injecting it in the dorsal region. He did not, however, conceive or practice the injection of the solution in the subarachnoid space, but thought that if it were injected between the spinous processes it would be absorbed and carried to the spinal nerves, producing the desired effect. His experiments were forgotten until 1891, when Quincke opened a new field in calling attention to spinal puncture. Then Bier in Berlin, and Tuffier, Chaput, and Forgue in France, began to practice subarachnoid anaesthesia as it is done today. Bier had it used on himself on one occasion, to show his faith in the method. In 1907 Barker published his article calling attention, for the first time, to the importance—from the standpoint of results—of the relationship that should exist between the densities of the spinal fluid and the anaesthetic solution.

The names of Jonnesco and Le Filliatre should not be omitted from even a brief history of spinal anaesthesia, as both have been most daring pioneers in the practice of high rachi-anaesthesia.

I have been employing spinal anaesthesia for the last seven years, and have no reason to regret having done so. The present report is based on the last 600 cases, concerning which a most critical attitude was taken in order to test thoroughly, and satisfy myself definitely, as to the real value of this form of anaesthesia.

Technique. — The patient is given ¼ grain of morphia, ½ hour before the operation. The ears are plugged with cotton. On the operating table, the patient is placed in the position of lateral decubitus (Figure A, below); the head and knees are approximated, in order to bring into prominence the spinous processes and widen the interspaces. With a sponge soaked in iodine, a perpendicular line is drawn from the crest of the ileum to a similar horizontal mid-vertebral line. The point of intersection of these two lines falls on the 4th lumbar interspace—the usual place of choice to make the puncture in order to obtain anaesthesia below the umbilicus. Puncturing 2 spaces above, and using slight pressure on injecting the solution, gives satisfactory anaesthesia for interventions below the diaphragm. We use platinum needles, as they do not rust and, most important, they bend but do not break. This precaution is necessary in order to minimize the danger of breaking off needles, an accident which is very apt to occur, sooner or later, among the class of patients with which we have to deal.

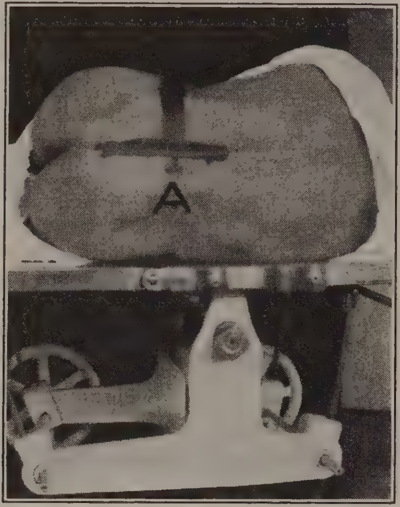


Figure A shows patient in position, and iodine lines indicate approximate place of puncture.

A very important point in the technique is assurance that the point of the puncture needle is actually in the subarachnoid space when the anaesthetic is injected. If the spinal fluid does not flow freely in a continuous stream or in rapid successive drops, the needle point is not in proper place and the solution should not be injected, as experience has shown us that the anaesthetic when injected under such conditions results in either partial anaesthesia or complete failure. When assured that the needle is in proper position, 10 to 15 cc. of spinal fluid (depending on the pressure) are withdrawn, and the anaesthetic is injected slowly. The needle is then withdrawn, the patient is turned on the back, the abdomen prepared, and by that time anaesthesia is usually far enough advanced to warrant starting the operation.

We have used both stovaine and novocain, but prefer the latter, administering it in doses varying from 50 to 120 milligrams, according to the probable duration of the operation and the weight of the patient.

Immediate Untoward Effects. — Ten or fifteen minutes after the injection, the patient may complain of a feeling of faintness and slight nausea. If the blood pressure is then taken, it will be found that it has dropped 15 to 20 points, and that the pulse has become slower. These phenomena are attributable to vasomotor disturbances due to paralysis of the rami communicantes, resulting in functional paralysis of the abdominal sympathetic nerves and involving the coeliac axis. All this brings about a general splanchnic dilatation and the collection of a large column of blood in the vessels of the viscera. Under such conditions the patient is instructed to breathe deeply through his nose; if he is not promptly relieved, 15 minims of adrenalin are given hypodermically, which will usually relieve the above-mentioned symptoms. In 5 instances of severe collapse occurring among my last 600 cases, 10 minims of adrenalin intravenously and a hypodermic injection of pituitrin gave relief in each case within a few minutes and the operations were continued without further interruption. In many cases a few whiffs of ether are sufficient to relieve the patient of these "fainting spells." In high anaesthesia for operations on the gall-bladder, stomach, spleen, etc., symptoms of pseudo-asphyxia are occasionally observed, which are due to partial paralysis of the intercostal muscles and are compensated for by abdominal breathing. The phrenic nerve is not affected.

Late Untoward Effects. — Probably the most common of these is puncture headache, the frequency and severity of which can be considerably reduced by using a small-caliber spinal-puncture needle and withdrawing from 10 to 15 cc. only of spinal fluid. A large-caliber needle produces a large opening in the dura, which permits spinal fluid to escape into surrounding tissues after its removal, causing a hypotension cephalalgia. Retention of urine, in our experience, occurs no oftener following spinal anaesthesia than when a general anaesthetic is given. Vesical paralysis occurred once in our last 600 cases. The condition disappeared 35 days after the operation. The case was an old arteriosclerotic patient with a chronic prostatitis, on whom we did an amputation of the leg above the knee for senile gangrene in the foot. We have never seen permanent paralysis or nerve lesions of any kind resulting from spinal anaesthesia.

We might mention, in passing, a case of transverse myelitis that occurred in one of our patients, on whom a circumcision was done under local anaesthesia. Had this case been operated on with spinal anaesthesia, as is commonly done in this hospital, we should have been confronted with a very puzzling situation in determining the aetiology of the condition. How many of the reports on nerve lesion following spinal anaesthesia are coincidences similar to this?

The important advantages of spinal anaesthesia are the following:

1. It is easily administered—there is no subarachnoid space that an experienced surgeon cannot puncture.

2. It does not require the presence of an anaesthetist during the course of the operation.

3. Its action is rapid—five minutes after its administration, the operation can be begun.

4. Once the abdomen is open, a complete "*silence abdominal,*" as the French surgeon so graphically expressed it, is encountered. This permits a more rapid operation, and reduces the usual amount of manipulation necessary, thereby causing less trauma to the intestines. The forced respiratory movements of general anaesthesia, which cause a continuous up and down motion of the intestines and other viscera, are entirely absent. One seems to be operating on a cadaver.

On observing the struggles of a patient going under a general anaesthetic I often wonder how many appendices and localized abscesses are ruptured, and how often the general peritoneal cavity is contaminated, during the course of these struggles. Perhaps the patient is *really going under.*

5. The post-anaesthetic morbidity is nil. When the operation is completed, the patient can be immediately put up in Fowler's position, if necessary, and accommodated in the most comfortable way.

6. No special nurse is required, as is the case when general anaesthesia is administered. This is a very important factor in hospitals with a limited nursing personnel.

7. Water and other liquids can be given by mouth immediately after the operation. A fact of such importance needs no emphasis here.

8. No stomach tube is needed to wash out highly irritated stomachs (ether stomachs).

9. As complete nerve block is obtained by spinal anaesthesia, the operative shock is abolished.

10. The anaesthetic is given in one dose—and only one—the necessary amount of which can be definitely determined beforehand.

11. It is particularly useful in major and minor genito-urinary work, especially in inguinal adenitis, urethral strictures, and circumcisions in which an anaesthetic is required and in which local or general methods are by no means ideal.

Contra-indications. — (1) Hypotension—blood pressure below 120 systolic is a contra-indication. (2) Exceedingly nervous patients. (3) Children—not because we think the anaesthesia is harmful to them, but because of the difficulty of keeping them quiet.

CONCLUSIONS

1. Spinal anaesthesia is a safe, rapid, efficient anaesthetic procedure.

2. It is particularly useful to the busy surgeons of small hospitals, who have no trained anaesthetists, no regular surgical teams, and only a limited nursing personnel.

3. It facilitates surgical technique.

4. In more than 1,500 cases, we have had no fatal accidents from the anaesthetic.

BIBLIOGRAPHY

Meredith, F. Campbell, *Annals of Surgery*, July, 1926, (p. 45)

SPINAL ANAESTHESIA

O. T. BROSIUS, M.D., AND I. E. PEON, M.D.
Almirante Hospital, Panama

Some General Remarks on Spinal Anaesthesia. — During the surgical service of one of us (O.T.B.) at Santo Tomas Hospital, Panama, from 1914 until 1917, spinal anaesthesia (stovaine .05 gm. to 0.10) was the anaesthetic of choice for all operations below the costal border. For those interested we recommend, as a reference thereto, the special report of Doctors Boyd and Yount which was published in the "Journal of the American Medical Association" during that period. Subsequent to that time, in the hospital of the Pato Mines, Colombia, and later in his practice in Barranquilla, Colombia, from 1917 until 1925, one of us (O.T.B.) had continued the use of stovaine as the ideal and safest form of anaesthesia, affording, as it does, a perfect nerve block, thus minimizing, as much as possible, the dangers of shock. In that it temporarily reduces blood pressure, it is of special value in operations on cases with hypertension, and its rôle as an anaesthetic in pulmonary conditions is of paramount importance. In over 1,000 cases in which it was administered during that time by himself, he (O.T.B.) observed no dangerous ill effects from the drug or the puncture, other than the violent headaches which occasionally occur after lumbar puncture, and which we now believe can be prevented by not allowing the patient to raise his head for at least twenty-four hours after the administration of the anaesthetic.

For the past eighteen months, as a matter of routine we have used spinal anaesthesia at the Almirante Hospital for most major and minor operations below the costal border.

Following a study made by one of us (I.E.P.) in the Southern States, relative to spinal anaesthesia, we have used stovaine less frequently, and have adopted in its stead the following technique for the use of apothesine in spinal anaesthesia.

*Technique of Administering Apothesine**. — In the average case, in which the operation will probably last less than one hour, usually no hypodermic is given, but in extensive pelvic cases, for example, a hypodermic of morphine grs. ¼ and scopolamine grs. 1/150 is administered 20 minutes prior to beginning the operation. This preliminary hypodermic has been proved to prolong the anaesthesia from 2 to 2½ hours, and it usually induces sleep during the greater part of the operation. Two tablets of apothesine containing 1¼ grs. each are dissolved in 3 cc. normal salt solution, boiled, and aspirated into a 10 cc. syringe. For pelvic work, the spine is usually punctured in the 4th lumbar interspace, and for upper abdominal work in the 2nd or 3rd lumbar interspace. After 3 to 4 cc. of spinal fluid are allowed to escape, the syringe containing the apothesine solution is connected with the spinal needle and from 3 to 4 cc. of spinal fluid are drawn into the syringe. The fluids are then well mixed and injected very slowly. The needle is then withdrawn, the puncture wound dressed, and the patient is quickly turned upon his back; he is kept in a recumbent position for twenty-four hours to prevent the development of puncture headache.

---

*Apothesine is a local anaesthetic of the procaine type. See page 51 of publication entitled "New and Official Remedies, 1926," issued by the American Medical Association, Chicago, Illinois, U. S. A.

Special Advantages of Spinal Anaesthesia. — The advantages of spinal anaesthesia are:—(1) It saves the services of a trained anaesthetist; (2) the patient can be anaesthetized in less time and with less trouble and suffering; (3) there is less nausea and vomiting after the operation; (4) the patient can be fed during, or immediately after, the operation if necessary or advisable; (5) post-operative distentions from gas in the intestines are minimized; (6) shock is for the most part prevented, as this anaesthesia produces a type of nerve block; (7) it lowers blood-pressure, and is the anaesthetic of choice in advanced life, especially in those cases with hypertension or chronic bronchitis; (8) the cost of a spinal anaesthesia is about ten cents — very much cheaper than any other form of general anaesthesia; (9) spinal anaesthesia is much less irritating to the kidneys than any other form.

Its Disadvantages. — These are the occasional, though avoidable, puncture headaches, and its contra-indication in low blood-pressure cases.

Spinal anaesthesia has been administered for 56 operations in this hospital, apothesine for 43, and stovaine for 13. All were major operations; 34 were laparotomies for pelvic diseases in women. Others were for herniotomies, gunshot wounds of abdomen, haemorrhoidectomies, amputations of the foot and leg, fractures, and disease in the bones of the lower limbs.

Case Illustrating Efficacy of Apothesine.— The efficacy of apothesine was demonstrated in the case of a young Panamanian woman admitted to the Almirante Hospital with gunshot wounds of the arm, chest, and abdomen. Owing to the injury to the lungs it was inadvisable to administer ether. An exploratory laparotomy was performed under apothesine spinal anaesthesia, and the abdomen was found to be full of blood which was issuing from gunshot wounds in the enlarged spleen, which weighed 6 pounds. To stop the haemorrhage a splenectomy was quickly performed, and then the intestines were explored for perforations, 6 of which were found and sutured. Following the operation the temperature went up to 104° F. and the pulse was barely perceptible at the wrist. Thereupon 500 cc. of typed blood was transfused, and the following morning a great deal of improvement was noticed. The pulse rate had dropped to 140 and the temperature to 102° F. Improvement continued without interruption, and the patient was discharged, perfectly well, 3 weeks later.

In this case it was possible to establish full anaesthesia with apothesine much more quickly than by any other known method, and the importance of this time-saving element, under the circumstances just detailed, is quite obvious.

SECTION VII

THE SNAKE-BITE PROBLEM IN THE UNITED STATES AND IN CENTRAL AMERICA

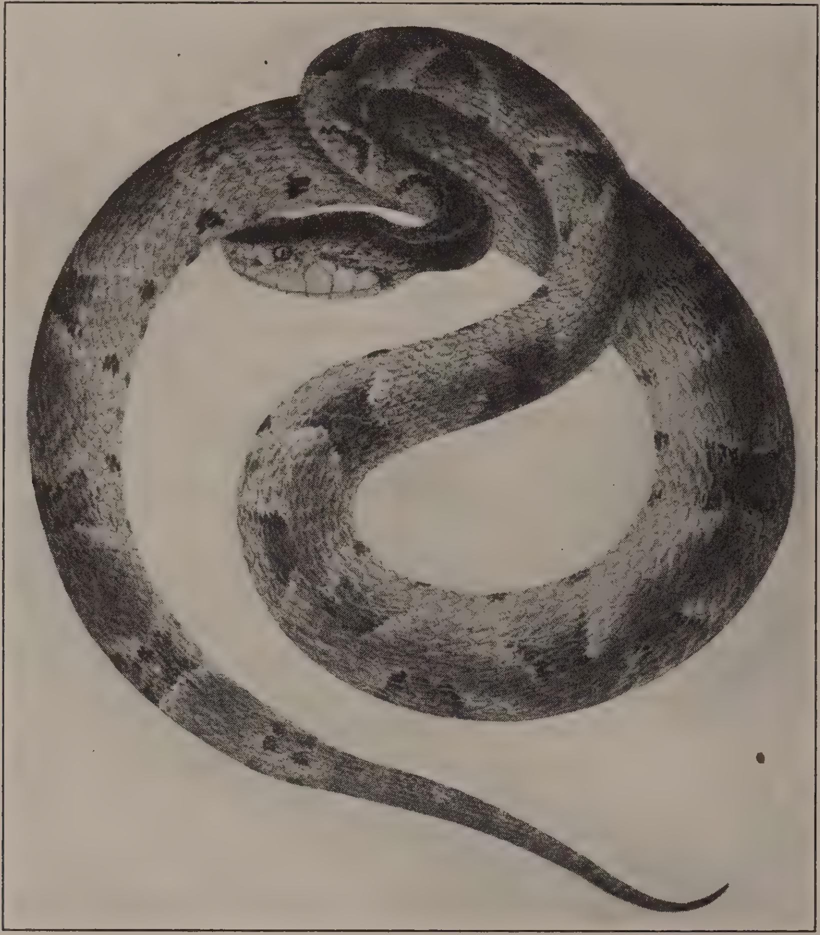
AFRANIO DO AMARAL, B.SC. & L., M.D., D.P.H.
Director, Antivenin Institute of America
Lecturer, Harvard University School of Public Health

Responding to a request from the Medical Department of the United Fruit Company, I am offering a short report on the progress of the Antivenin Institute of America. I am also submitting, concerning the management of snake-bite cases, some instructions that may be passed on to the various divisions of the United Fruit Company so that they can not only standardize their procedure in the care of such cases but also be of some assistance to our Antivenin Institute.

Early last summer I motored through the United States, especially the south and west, with the idea in mind of finding out how serious the snake-bite problem is in those sections. Advantage was taken of this opportunity to show as many laborers, farmers, and campers as possible what they should do to prevent snake-bites. I think I proved to them, quite conclusively, that in the majority of cases the use of heavy shoes and leggings affords one very good protection, not only against poisonous serpents, but also against the hookworm, which represents another scourge of mankind in the Tropics and sub-Tropics. These people have been advised not to destroy systematically all snakes that they encounter, but to catch and deliver alive to a serpentarium the poison species. These species are indispensable in the preparation of antivenin. The non-poisonous snakes should be spared, for they are of great benefit, as a rule, in the farming regions because they live mostly on rats, mice, moles, and other rodents that are pests to agriculturists.

Through the experience gained on my trip and the study that I made of all available statistical data, I have come to the conclusion that there are annually, in this country, more than 1,000 cases of snake-bite by poisonous species. I believe that the mortality rate in such accidents runs from 10 per cent in the northeast, middle west, and northwest, to 25 per cent in the southeast and 35 per cent in the southwest. The number of bites is greater in the southwest than anywhere else in the United States. Ophidism is becoming more and more of a problem in the United States, as well as in Central America, because of a number of circumstances that operate in the same direction:

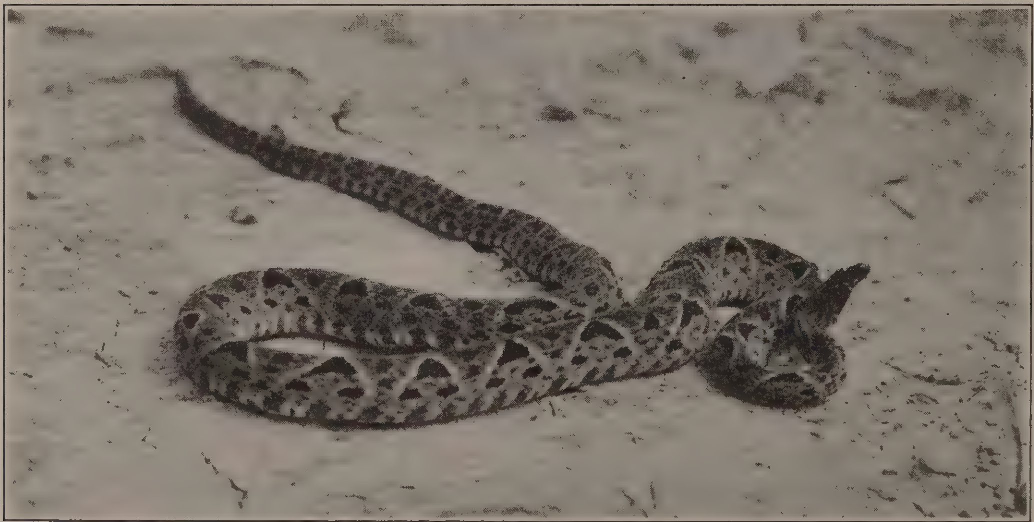
1. The clearing of the primitive jungle growth (contrary to general opinion) is followed by a rapid increase in the number of snakes, provided that agricultural development follows the clearing of the jungle.



(After A. do Amaral's plate in "General Consideration of Snake Poisoning and Observations on Neotropical Pit-Vipers," Harvard University Press, 1925)

No. 1

Bothrops atrox, Known as the Fer-de-lance, Barba amarilla, and Terciopelo



No. 2

Bothrops atrox, Taken at the Tela Serpentarium

2. Successful agricultural development produces an abundant and easily accessible supply of food and shelter for rodent life, thus causing it to multiply. Particularly is this true regarding the rats which form the chief article of diet for the vipers in North and Central America. This circumstance, in turn, influences the breeding of such snakes in the lowland plantations.

3. A primitive jungle area or a neglected district is practically an unpopulated region, but the agricultural development of such areas is naturally associated with an influx of population that consists largely of field laborers. Thus, obviously, the chances for snake-bites are enhanced.

It is a curious fact, but nevertheless a natural sequence, that progress in agriculture generally aggravates the dangers of ophidism by markedly contributing toward the numerical increase of human beings, rodents, and serpents, the three main factors involved in the problem. Agricultural pursuits also introduce the use of a large number of domestic animals that are exposed to the danger of snake-bite. Unfortunately, statistics are far from complete regarding such accidents among domestic animals. I learned while traveling through the southwest that in Texas alone, during the last two or three years, snake-bite has been responsible for an annual loss of over one million dollars' worth of cattle.

(With permission of Dr. T. Barbour and Mr. G. E. Nelson, Museum of Comparative Zoology, Cambridge, Mass.)

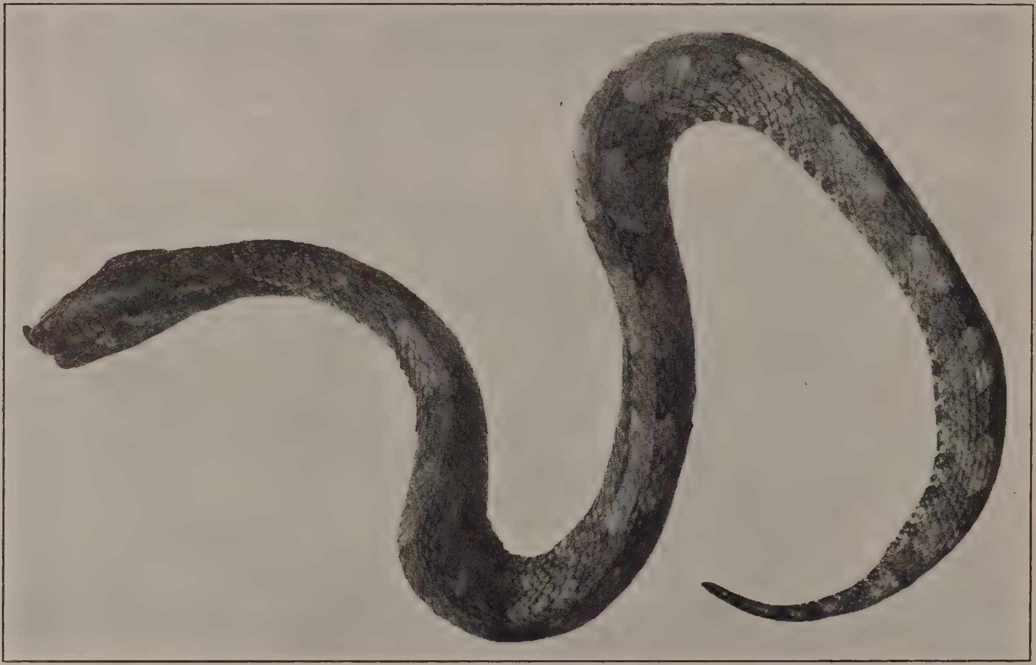
No. 3

Bothrops schlegelii, Known as the Horned Palm Viper, Bocaracá, Toboba de pestanas, Oropel, and Sleeping gough

The Antivenin Institute of America has been recently organized, as a subdivision of the Mulford Biological Laboratories, to face the problem of snake-bite in all its aspects. It has the hearty encouragement and support of a few broad-minded, progressive individuals and of certain educational, scientific, and commercial organizations. Among the individuals actively interested are: Dr. Thomas Barbour, of the Museum of Comparative Zoology, Harvard University;

Mr. Raymond Ditmars, of the New York Zoological Park; Col. Martin Crimmins, U.S.A., Ret.; Maj. Raymond Scott, M.C., U.S.A.; Mr. Lawrence Klauber, of the San Diego Zoological Park; and Dr. William Scheppegrell, of the New Orleans Zoological Park.

The institutions supporting the project are: The United Fruit Company, the New York Zoological Society, the Philadelphia Zoological Society, and the Zoological Society of San Diego.



(After Specimen No. 15,296 in the Museum of Comparative Zoology, Cambridge, Mass.)

No. 4

Bothrops brachystoma, Known as the Hog-Nosed Viper and also as the Tamaga

The organization of the Antivenin Institute of America, as it stands at present, is the following:

- A. Central Laboratory and Snake House
  - Glenolden, Penn.
- B. Nearctic Section
  - Mr. R. L. Ditmars in Charge (New York Zoological Park)
  - (a) San Antonio, Tex., Station
    - Col. M. L. Crimmins, U.S.A., Ret., Field Assistant in Charge
    - Maj. R. E. Scott, M.C., U.S.A., Laboratory Assistant
  - (b) San Diego, Cal., Station
    - Mr. L. M. Klauber, Assistant, (San Diego Zoological Park)

C. Neotropical Section
  Dr. Thomas Barbour in Charge (Harvard University Museum of Comparative Zoology)
  (a) Tela, Honduras, Station (Laboratory and Serpentarium)
    Mr. Douglas March, Assistant

Advisory Board

Prof. Hans Zinsser, Harvard University
Col. Joseph Siler, M.C., U.S.A.
Prof. Howard Kelly, Ret., Johns Hopkins University
Drs. W. E. Deeks and H. C. Clark, Medical Department, United Fruit Co.

Scientific Organ

The Bulletin of the Antivenin Institute of America, a quarterly, the first issue of which will come out early in the year 1927.

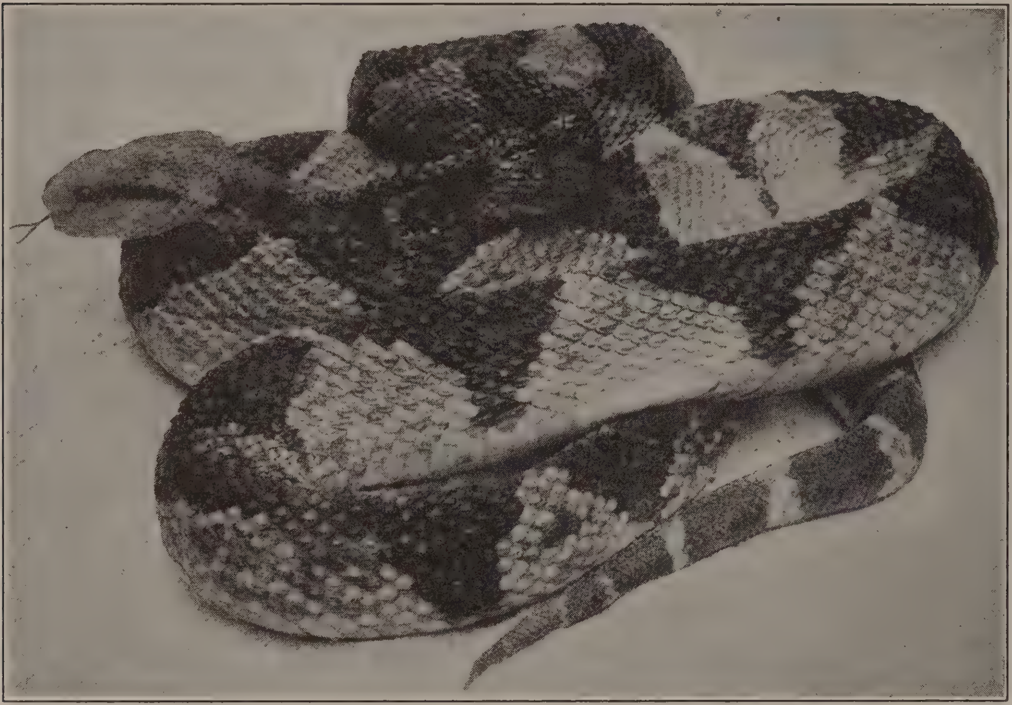
(After a specimen in A. do Amaral's Collection)
No. 5
Micrurus nigrocinctus (*Micrurus fulvius, Elaps fulvius*), Known as the Harlequin Snake, Coral Snake, and Gargantilla

It did not take very long for our North American stations to be placed on a complete operating basis by the competent assistants in charge. They have succeeded—July to October, 1926—in obtaining venom from over 4,000 rattlesnakes, as well as from many copperheads and moccasins. Moreover, in order to reach people bitten by snakes far in the country, and give them serum, the Army and Navy aeroplanes, working in connection with our stations in the southwest, flew more than 3,000 miles this year. It seems fair to anticipate that the anti-ophidic campaign in this country will become even more successful than it has been in Brazil.

In regard to our work in Central America, it is hoped that the different divisions of the United Fruit Company will continue to show increasing interest in the snake catches and in the careful observation of their cases of snake-bite. The assistance they have already given our representative, Mr. Douglas March, in charge of our Serpentarium and Laboratory, at Tela, Honduras, is indeed very encouraging. I believe their work will be even more useful and profitable if they always endeavor to have their plantation laborers capture the poison snakes that they encounter and send them to the Serpentarium, where they can be made of scientific use.

ADVICE IN SNAKE-BITE PROCEDURE

1. *Catch the snake that caused the accident.* The identity of the species must be known, if the correct specific antivenin is to be used in the treatment of the case. Without this knowledge, the treatment of the case will be less successful, and our statistics can not be made complete and scientific. Each division can thus receive due acknowledgment for its contribution toward the advancement of science, since any specimens that are collected will be utilized, also, in the study of the geographical distribution of species and their relative incidence and economic importance.



(*By permission of Mr. R. L. Ditmars, New York Zoological Park, Curator, Reptiles*)

No. 6

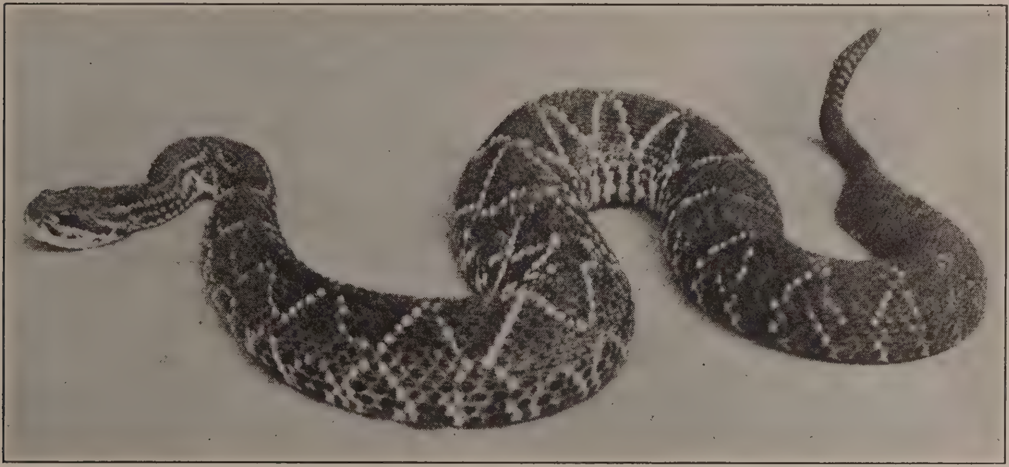
Lachesis mutus, Known Generally as the Bushmaster

2. *Apply a tourniquet above the knee or elbow whenever the bite is located below these levels.* More than 75 per cent of the bites occur on the feet, ankles, hands, or wrists. For a tourniquet, almost anything like strings, strips of clothing, vines, etc., can be used. The tourniquet should be applied firmly enough to prevent the flow of blood in the veins, but not tightly enough to prevent the flow through the artery. In other words, tie it tightly enough to cause the limb to become blue, but not white or blanched. The tourniquet should be released for a few seconds, at intervals of ten minutes, in order to prevent gangrene of the

tissue below the level of the constriction. Applied below the knee or below the elbow, a tourniquet can not be as successful, because the flow in veins that lie between the bones of the leg or forearm cannot be as effectively controlled.

Remember that some of the serious results from snake-bite are due more to severe, long-continued constriction by the tourniquet than to the toxic property of the venom itself.

3. *Send the patient* (and *also the snake*, for its identification) *immediately to the hospital* where proper care and treatment can be instituted. Telephone that the case is on the way from a given station, for sometimes the snake-bite occurs at such a great distance from the hospital that too much time is lost before the antivenin can be administered. It may, at times, be very necessary for a doctor to go out and meet the patient somewhere along the line, in order to administer treatment soon enough after the accident to prevent serious results.



(From the Laboratory of São Paulo, Brazil)
No. 7
Crotalus terrificus, Known as the Rattlesnake and Cascabela

The doctor who makes such a trip should take with him a tube of each type of antivenin carried in stock, in order that he may be prepared to select the proper one after identifying the species. The injection of the antivenin may be given hypodermically or intravenously, according to the severity and duration of the poisoning. Stimulants, such as strychnine and caffeine, may also be given when indicated, but avoid the use of alcohol.

The modern treatment in snake-bite poisoning requires that the doctor be able to recognize the young and the old specimens of the poison species in his locality, in order that he may safely select the antivenin for any given case.

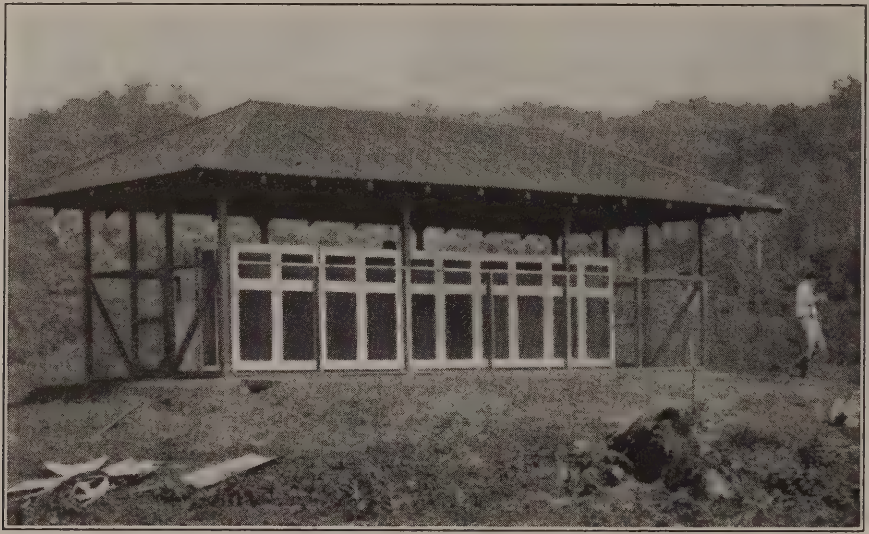
The species of poison snakes to which the inhabitants of the United Fruit Company divisions are most liable to be exposed are the following:

1. *Bothrops atrox* is generally known as the "fer-de-lance," but it is also locally called "terciopelo," and "barba amarilla." It is perhaps the most abundant of the dangerous reptiles to be found in the mainland divisions, from Colombia to Guatemala. In Honduras, it is found in especially large numbers.

2. *Bothrops schlegelii.* This is more commonly known as the "horned palm viper," but it is also known locally as the "bocaracá," "toboba de pestanas," "oropel," and "sleeping gough." It is nearly always found in a small tree or bush.

3. *Bothrops brachystoma*, the hog-nosed viper, is also known as the "tamaga."

4. *Lachesis mutus* is generally called the "bushmaster," but it also bears a local name peculiar to each country in which it is found. It is most common, so far as we know at present, in the divisions of Colombia and Panama.



No. 8
Tela Serpentarium, Tela, Honduras

5. *Crotalus terrificus*, commonly known as the rattlesnake, bears the local name of "cascabela." It is believed to be rather common in Colombia, and has been less frequently reported in the other mainland divisions. Usually it is found at an altitude higher than that of the banana plantations in the Central American divisions.

6. *Micrurus nigrocinctus*, the coral snake, is found in Colombia, Panama, and all other Central American mainland divisions. It seldom bites. This species is also known as the "harlequin snake" and the "gargantilla."

Antivenins are usually prepared in such a manner that one commercial product will cover the needs of treatment for the bite of several species of snakes. For instance our bothropic antivenin can be successfully used for the bite of the following snakes: the fer-de-lance (barba amarilla, terciopelo); the toboba (horned palm viper, bocaraca, oropel, sleeping gough); the tamaga; and the lora. Each of the following species, however, requires its specific antivenin: the bushmaster, cascabela, and coral snake.

What has just been said will clearly indicate the necessity of knowing what species of poison snake is responsible for any particular accident. Furthermore, I can never over-emphasize the necessity of capturing as many of the local poison snakes as possible, since it is my experience that one single New-World, truly venomous snake, to whatever genus it may belong (*Agkistrodon, Bothrops, Sistrurus, Crotalus,* or *Lachesis*), if properly handled, will surely give enough venom to prepare sufficient antivenin for the cure of at least four or five snake-bitten people.

We hope to issue at a later date a pamphlet illustrating, in colored plates, the poison snakes of the north coast of South America, as well as of Central America and the United States. A brief account of the toxic properties of each species will also be given.

CASES OF SNAKE-BITE TREATED IN ALMIRANTE HOSPITAL, PANAMA, DURING THE YEARS 1922–1926, INCLUSIVE

H. R. Eichelbaum, M.D.

Almirante Hospital, Panama

The number of snake-bite cases treated in this hospital from 1922 to 1926, inclusive, was very small compared to the number of persons admitted for other accidents and for diseases.

Snakes are numerous here, but they are encountered mainly by the laborers at work on the plantations. Our medical records probably do not reflect correctly the incidence of snake-bite accidents. A trustworthy "curandero" recently told me that he had treated 81 cases of snake-bite that had occurred in this locality during the past two years! A number of these so-called snake-doctors exist in our region, and they all are alleged to have treated a certain number of such cases. One of these specialists maintains a clinic in Guabito and advertises himself each week in the local newspaper, offering a form of snake-bite insurance to his patrons at the rate of fifty cents a month!

Various reasons exist to explain why our hospital treatment is neglected or discredited in cases of snake-bite. Some of these explanations might be listed as follows:

1. The party bitten is usually an uneducated laborer who is at a great distance from the hospital at the time of the accident. He may either recover or die before he can reach the hospital.

2. Many snake-bite accidents are not followed by serious results. Either the snake was not a poison species or, if it was, at the time it struck the individual it had empty glands, as a result of a recent ingestion of its food. Most of our

poison snakes are *night feeders* and our men are usually bitten in the daytime by a snake that has fed during the previous night.

3. We have never been prepared, until recently, to offer scientific treatment with a specific antivenin, and this fact, together with the others just mentioned, has permitted the local snake-doctor to build up quite a reputation in the management of such cases.

The venomous species that are believed to exist in the Province of Bocas del Toro, Panama, are listed below:

1. Terciopelo, or fer-de-lance (*Bothrops atrox*)
2. Bushmaster (*Lachesis mutus*)
3. Coral snake, or harlequin snake (*Micrurus nigrocinctus*)
4. Bocaraca, toboba de pestanas, sleeping gough, or the horned palm viper (*Bothrops schlegelii*)
5. Tamaga, or hog-nosed viper (*Bothrops brachystoma*)
6. Cascabela, or rattlesnake (*Crotalus terrificus*)

The member of the list found in greatest numbers, and believed responsible for most of our serious cases of snake-bite poisoning, is the terciopelo or fer-de-lance.

A review of the total of 25 cases treated in the hospital from 1922 to 1926, inclusive, is given below:

2 patients were bitten by *L. mutus* (bushmaster). Both of these patients died.
3 patients were bitten by *B. atrox* (terciopelo, or fer-de-lance). One of them died.
4 patients were bitten by *B. brachystoma?* (tamaga, or hog-nosed viper?). No deaths were reported.
2 patients were said to have been bitten by the coral snake (*Micrurus nigrocinctus*). No deaths reported.
4 patients were bitten, possibly, by the bushmaster or the fer-de-lance. One of them died.
2 patients were bitten, possibly, by coral snakes. No deaths noted.
8 patients were bitten by unknown species of snakes. Two of them died.

Twenty-four of the people bitten were men, and the other was a woman. The 1 woman and 5 of the men died.

The 25 cases by race show: negroes, 12; mestizoes, 9; Indians, 4.

The victims were struck on the leg or the foot in 15 of the cases, and on the hand in 10 of the cases.

In 14 of the cases, there was local oedema, with discoloration about the region of the wound and oozing from the fang punctures; associated with this, there were haematuria and bleeding from the lungs, gums, nose, and intestines. Gangrene developed in a wide area about the fang punctures in 3 of the cases, and there were 4 others which developed only local oedema at the site of the bite with an associated feeling of drowsiness. In 7 other cases there was local oedema at the site of the wound with no constitutional symptoms.

AUTOPSY RECORD ON A FATAL CASE

(Species of viper not stated)

Rigor of death noted.

Fang punctures were found on the leg. The skin and subcutaneous tissue in the region of the fang marks were necrotic, and the entire leg was oedematous and discolored. Local haemorrhages were present in the skin. The blood in the large vessels, four hours after death, was in a fluid state.

Oesophagus, thyroid gland, and aorta were normal.

Heart. — Contracted ventricles. Epicardium and endocardium were dotted with ecchymoses. The muscle was anaemic and had a "boiled color" appearance.

Lungs. — The pleura covering the lower parts showed petechiae, and there were a few small haemorrhagic infarcts. The bronchial trees were filled with blood-stained fluid, and a similar fluid escaped from the cut surface of the parenchyma.

Spleen. — Slight enlargement noted. The Malpighian bodies were visible.

Kidneys. — The peri-renal tissues showed a bloody extravasation. The parenchyma presented a waxy appearance, and the glomeruli and tubules were visible macroscopically. The adrenals were negative.

Liver. — The cut surfaces presented a yellowish color, and there seemed to be a definite fatty change present.

Stomach was dilated and filled with bile-stained fluid. Haemorrhages were visible in the mucosa.

Pancreas. — Negative.

Intestines. — Haemorrhages were visible in the mucosa.

Bladder. — A small amount of bloody urine was present.

MICROSCOPIC PATHOLOGY (DR. MALLORY)

Lungs. — Partly collapsed. A little serous exudate in some of the alveoli. Extravasated blood and ghost cells of erythrocytes in most of the alveolar spaces. The tunica intima is missing or fragmented in most of the blood vessels. The adventitia and media are apparently normal. The congested capillaries contain numerous hyaline, fibrin thrombi.

Spleen. — Congested. Slight toxic reaction in the centers of some of the lymph nodules. Endothelial leucocytes containing nuclear fragments. Moderate infiltration with eosinophiles.

Liver. — Congested. A few fibrin thrombi in sinusoids. Extravasated blood in many places. Focal necrosis present. The Kupffer's cells are laden with cell detritus and blood pigment. Some infiltration with lymphocytes around the portal vessels.

Kidneys. — Congested and oedematous. Each of the Bowman's capsules contains some blood pigment and fibrin. The pigment increases downward along the medullary rays as far as the collecting tubules. The latter are entirely filled with this material. The epithelium of the tubules is partly necrotic and fills the lumina. The endothelial cells lining all the blood vessels show marked degenerative changes, while in some of the vessels, large enough to have three coats, the cell space relationship and staining properties have undergone marked changes.

Skin. — Extensive diffuse haemorrhages.

There seems to be a general hyalin thrombosis of most of the organs.

Since we have been supplied with the Brazilian antivenins we have been able to treat 15 of the cases included in this series of 25. We used antivenin No. 2 or No. 3 in all the cases. Death occurred in 2 of the 15 cases treated. One of these fatal cases did not receive treatment until 4 days after being bitten. He died within an hour after reaching the hospital. The other fatal case was not treated until 50 hours after the biting had occurred. The people who recovered were treated within from 30 minutes to 8 hours after being bitten.

SNAKE-BITES

SPECIAL REPORT FROM PUERTO CASTILLA, HONDURAS

B. M. Phelps, M.D.

SCARCITY OF HOSPITAL CASES

Unverified reports have come to us concerning snake-bite cases that have occurred in the remote parts of our division. Since very few victims of such accidents are received for treatment in our dispensaries or in the hospital, we were led to investigate the reports. We asked for information through the channels of the Departments of Agriculture and Engineering. The following report was received on Dec. 21, 1926, from the Chief Engineer and Superintendent of Railways: "We have had no case of snake-bite during the year 1926."

The Department of Agriculture received a report from one of its farm overseers, who stated that he had heard of a man being bitten by a snake, but was unable to obtain information about the species, the kind of treatment employed, or the results of the accident. The Black River District also reported that three men had been bitten during the year. Two of these men were treated by local "snake-doctors," and both died. The third man was sent to the hospital for treatment. The following is a detailed report of this case:

CASE REPORT

Case. — Male, Honduranian, age 40 years.

Personal History. — He stated that while he was bending forward, cutting brush, a snake struck his leg. He killed the snake, which was about 3 feet long, and carried it to the camp, where some one told him that it was a *barba amarilla* (*fer-de-lance*). It was not sent to the hospital for identification. About an hour after the accident the man returned to the camp, where another man gave him some kind of medicine. Two hours after the accident, the entire foot, leg, and thigh became swollen. He had pain in the leg at first, but later—about 24 hours after receiving the bite—there was a loss of sensation to pain and touch, all over the foot and leg; at this time there was also some bleeding from the gums. These conditions lasted about 6 hours.

Physical Examination. — Patient was a well-developed and well-nourished man. Two small puncture wounds were found, with a space of ½ inch between. These fang marks were located on the external surface of the right thigh, 3 inches above the knee joint. A red area about 2 inches in diameter had developed around the punctures. Sensation of pain was diminished over the dorsum of the foot and the entire leg, and there was a partial loss of sensation over the external surface of the thigh. Patient complained of pain, on pressure, over the upper, inner surface of the thigh. He had a few decayed teeth, and the gums were spongy but showed only a slight tendency to bleed, on pressure. Spleen was enlarged to 3 fingers below the costal margin.

Laboratory Reports. — No malarial parasites were found. Urine findings were normal. Stool was positive for hookworm.

Treatment. — Patient was given one ampoule of anti-bothropic serum a few minutes after his admission to the hospital; 5 hours later he was given 2 oz. magnesium sulphate. A liquid diet was ordered.

Progress Notes. — Temperature, on admission, was subnormal and pulse rate 60. Temperature never rose above normal, and pulse rate never above 72.

Nov. 27. — Improvement in sensation was noted, the day after admission, over the foot, most marked on the medial surface, and over the external surface of the thigh. Patient complained of dizziness, at times.

Nov. 28. — Sensation was practically normal over the foot, leg, and thigh. He complained of weakness and dizziness and sharp pain in the wound at times.

Nov. 29. — Complained of weakness.

Nov. 30. — Wound had healed. No complaint.

This man was kept in the hospital for 7 days, and was given the chenopodium treatment for hookworm. He was discharged, as cured, on the 8th day. Readmitted on Jan. 3, 1927, to be treated for machete wounds, he reported that no further symptoms from the bite developed after his discharge from the hospital.

REPORT OF SNAKE-BITE CASES

R. B. NUTTER, M.D.
Tela Hospital, Tela, Honduras

The following cases of snake-bite poisoning that occurred within the limits of our Division during the present year are herewith submitted:

CASE 1

Case History. — No. 4,156.

Admitted to hospital March 6, 1926, at 6.15 P.M., 25 hours after the accident had occurred.

History. — While walking along the railroad track in the Guaymas district, about 5 P.M. on March 5, 1926, the patient was bitten by a snake. It struck him on the base of the left, 4th toe. He states that the reptile was about 4 feet, 6 inches long, with a rough skin and diamond markings. He is sure it was a barba amarilla (fer-de-lance). The snake was not killed.

First Aid. — The wound was incised and cauterized on the morning of March 6, 1926, at the Guaymas dispensary. A tight bandage had been applied as a tourniquet above the ankle and below the knee.

Symptoms. — There was bleeding from the nose and mouth about 3 hours after he was bitten. He continued to expectorate bloody saliva, and blood oozed from the nose. There was no pain or vomiting, and only a moderate degree of prostration.

Physical Examination. — He was a well-developed, but poorly nourished and anaemic, Honduranian laborer. A cauterized, incised wound was observed at the base of the left, 4th toe. There was moderate swelling of the left foot and ankle. The toe wound continued to bleed. *Spleen* was enlarged. *Heart, lungs, and abdomen* were negative. *Pulse rate* was 100, and the quality was good. *Temperature* was 99°.

Laboratory Reports. — *Blood*—negative for parasites; haemoglobin—55 per cent. *Wassermann and Kahn tests* negative. *Urine*—Trace of albumin, and large amount of blood present. *Stools*—uncinaria, ascaris, and some cysts of *E. coli* found.

Treatment. — One ampoule of anti-bothropic serum was given subcutaneously, at the time of admission. Tincture of digitalis, 20 minims, was given twice daily for 10 days.

Progress Notes. — The wound on the toe continued to bleed for 4 days. The swelling of the foot and ankle subsided after 1 week. The 6th day after admission he expectorated a small amount of blood and had a slight haemorrhage from the left nostril. The toe later became gangrenous, and had to be amputated on the 8th day after admission. Patient regained his strength slowly.

Result on Discharge. — Discharged April 10, 1926. Recovery, with loss of the left 4th toe.

CASE 2

Case History. — No. 6,408.

Admitted to hospital October 21, 1926, at noon, 4 hours after the accident.

History. — While cutting bush on Farm 24 in the Guaymas district, at about 8 A.M., October 21st, he was struck on the left leg by a snake, which he killed and brought in for identification. It was a specimen of the fer-de-lance, about 36 inches in length.

First Aid. — None. No ligature applied.

Symptoms. — He had severe pain as high as the mid-thigh region, and about 2 hours after the accident he began to vomit and to expectorate bloody saliva.

Physical Examination. — The patient was a well-nourished, well-developed Honduranian laborer. He had an anxious expression, and showed a moderate degree of prostration. There was a single puncture wound, 9 inches above the left external malleolus. Swelling and tenderness were noted in the left leg. He was vomiting and expectorating blood, which also oozed from the bite-wound and from the gums. *Chest and abdomen* were negative. *Pulse* was of low tension and had a rate of 60. *Temperature* was 98.6°.

Laboratory Notes. — *Blood*—negative for malaria, October 22nd. *Kahn test* negative. *Stools*—negative. *Urine*—albumin, casts, and blood present.

Treatment. — The patient was given one ampoule of anti-bothropic serum, subcutaneously. Strychnine was given, 1/30 of a grain every 4 hours for 4 days.

Progress Notes. — The expectoration of bloody saliva and the oozing from the bite-wound continued for 24 hours. The swelling of the leg and thigh persisted for 3 weeks, and there was some induration over the calf muscles, with tenderness and stiffness until the time of the patient's discharge. From the 2nd until the 7th day he had an afternoon temperature of 100° to 101° F. The pulse was never over 100.

Result on discharge. — Discharged December 11, 1926. Recovery, with some tenderness and stiffness of the left leg.

CASE 3

Case History. — No. 6,793.

Admitted to hospital December 3, 1926. Hour not stated.

History. — He was bitten by a snake on the dorsal aspect of the proximal phalanx of the right 4th finger at 9 A.M., Dec. 3, 1926. The accident occurred in the Guaymas district. The snake, about 18 inches long, was identified as a young barba amarilla, or fer-de-lance. The patient discovered 2 pin-point fang punctures, about 3/8 of an inch apart, and located in a transverse fashion across the finger.

First Aid. — Fifteen minutes after the accident he was treated in the Guaymas dispensary. The puncture wounds were incised and a dressing was applied—also a tight bandage above the wrist. The patient had previously attempted to "massage" the poison out, and then applied tobacco to the wound. Some herb that is supposed to be a cure for snake-bite was also used.

Symptoms. — Immediately following the snake-bite, he felt pain up to the shoulder. Very soon, he became nauseated and vomited.

Physical Examination. — The patient was a well-developed, well-nourished Salvadorian laborer. Right hand and forearm were swollen. No fang punctures were visible, because of the longitudinal incision that had been made on the dorsal surface of the right 4th finger over the proximal phalanx. The patient was not toxic in appearance, and did not feel sick at the time of the examination.

Preparation was made to administer anti-bothropic serum, but the staff considered that only local treatment was required and doubted that the wound had been caused by a fer-de-lance.

Laboratory Notes. — *Blood*—negative for malaria. *Kahn test* positive. *Stools*—positive for ascaris, uncinaria, and cysts of *E. coli.*

Treatment. — One ampoule of anti-bothropic serum was given, subcutaneously, at 7.30 P.M., Dec. 4, 1926 (22.5 hours after the accident had occurred).

Progress Notes:

Dec. 4th, A.M. No pain or bleeding. Forearm swollen.

Dec. 4th, 2.30 P.M. Complained of pain extending up to the shoulder. No increase in the swelling of the forearm.

Dec. 4th, 7 P.M. Pain increased and the swelling of the forearm had advanced to the upper arm. *Temperature,* 99° F.; *pulse,* 88; no vomiting or bleeding, yet patient's general condition was worse.

Dec. 5th (*morning* following the use of antivenin). There was no pain but some bleeding occurred at the snake-bite wound. The swelling of the arm was apparently decreasing. General condition was improved.

Dec. 5th, P.M. Patient felt much better, and the swelling subsiding rapidly. No pain.

Dec. 6th. Numbness in all fingers of the hand. Very little swelling noted.

Dec. 11th. The wound was healed. There was slight numbness in the fingers, but otherwise patient felt well.

Result on Discharge. — He was discharged Dec. 11, 1926. Recovery, with slight numbness remaining in the fingers.

CASE 4

Case History. — No. 7,444.

Admitted Feb. 10, 1927, immediately after the accident.

History. — The patient is the superintendent of the Tela serpentarium. He was bitten, about 10.40 A.M. on Feb. 10, 1927, by a fer-de-lance 3½ feet long. It struck him on the left thumb, at the right base of the nail.

First Aid. — The wound was immediately sucked, and a shoe-lace was applied as a ligature about the base of the thumb. The patient at once started for the hospital and was met on his way by a hospital physician, who immediately injected subcutaneously an ampoule of anti-bothropic serum in the left scapular region. The wound was incised. Only one fang puncture was found.

Symptoms. — Within 2 minutes after the snake struck, the man became blind for a few minutes. On admission to hospital pulse rate was 65, which dropped to 50 in half an hour; the volume also was poor. He complained of nausea and of pain in the entire arm, but especially in the thumb at the site of the shoe-lace tourniquet. A rubber catheter was applied below the shoe-lace, and the latter was then removed. An hour later a tourniquet was applied above the elbow, and the one on the thumb was removed. The tourniquet above the elbow was removed at the end of an hour's time. Forty minutes after the snake-bite, the patient vomited and expectorated blood. This condition persisted for 24 hours, during which period also the wound bled freely. No haemorrhages were found in the skin.

Physical Examination. — The patient, an adult, white man, had a single fang puncture at the base of the left thumb nail, and the hand was moderately swollen.

Treatment. — One ampoule of anti-bothropic serum was given subcutaneously almost immediately after the man was struck. Stimulation was used for a few hours. The wound was sucked, incised, and dressed; a tourniquet was applied to the base of the thumb, and later above the elbow.

Progress Notes. — *Feb. 11th,* his general condition was improved, but he felt weak and the hand was swollen. *Feb. 12th,* patient weak; moderate swelling of the hand. *Feb. 13th,* he visited dispensary; the hand was still swollen and there was necrosis about the wound at the base of the thumb nail. He stated that he had formerly been bitten by rattlesnakes, copperheads, and moccasins, but that the effects of those bites were not so severe nor so prompt in their manifestations.

Result on Discharge. — He was discharged, on his own request, Feb. 12th. He will probably lose the nail; if so, it will be the fourth one that he has lost from the same cause.

THE BIOLOGY, IMMATURE STAGES, AND CONTROL OF THE SANDFLIES (BITING CERATOPOGONINAE) AT PUERTO CASTILLA, HONDURAS

REGINALD H. PAINTER, PH.D.
Kansas State Agricultural College

INTRODUCTION

In and about Puerto Castilla, Honduras, the prevalence of certain small, blood-sucking insects of the subfamily *Ceratopogoninae* has proved to be extremely troublesome. The investigation, of which this is a report, was undertaken in order to determine the breeding places and life histories of these insects, and to work out methods of control. I wish to thank Dr. W. E. Deeks, General Manager of the United Fruit Company's Medical Department for the opportunity of undertaking this investigation, and also to express my appreciation to Dr. B. M. Phelps, Superintendent of the Medical Department and to other officers and employees of the Truxillo Railroad Company, for the many courtesies extended to me during my stay in the division. My thanks are also due to my wife, Elizabeth M. Painter, for help with the manuscript and the drawings of immature stages of the sandfly, and also for aid in securing material so that I was able to carry on experiments in two places during the same period. I wish to thank also Dr. W. A. Hoffman, of the Department of Medical Zoology, Johns Hopkins University, for identification of adults and verification of my own identifications.

My investigation in Honduras occupied the time from April 1 to June 27, 1926, and included a few one- or two-day trips along the Truxillo Railroad to determine the extent of spread inland of the species studied. Life-history data refer only to the season in which the studies were made. The report on the investigation is divided into two parts: — The first deals with the general conditions found, the habits of the different species at various stages, the ecology of larval habitats, and methods of control; the second gives detailed descriptions of the larvae and pupae of the species reared.

PART I

Methods Used. — In the attempt to find the breeding place of the sandflies, material (sand, mud, water, etc.) was brought in from a number of promising localities. As soon as a place was found where a particular species was breeding in numbers, some of this material was collected and examined, often microscopically, for the presence of larvae and pupae. It was placed immediately in Mason jars and, with as little disturbance as possible, was brought into the laboratory, where each jar was covered with a muslin bag to catch emerging insects. The contents were examined daily. When we collected the material to test in this manner for the presence of immature stages of the sandflies, we tried to get the extremes of distribution in relation to different types of conditions under which insects would breed, rather than a series of exact locations, in the swamp, of much the same type of locality in which the insects were fairly certain to be breeding. This procedure has naturally resulted in the bringing in of considerable material which yielded nothing in the way of sandflies, but which will be of importance in determination of the places where it will be unnecessary to apply methods of control.

In the testing for the immature stages the sand and mud known to contain sandflies were examined for larvae or pupae resembling the similar stages of Ceratopogoninae, which have been previously described in Europe and North America. Brief notes were made of each individual discovered and separated, in order that it might be reidentified, and the larvae were placed in watch glasses in water, the pupae on wet sand in a small vial. In each of these vials the sand, which had previously been sterilized, was arranged so that it was slanting up along one side of the vial, leaving water at the bottom of the incline and only moist sand at the top. This appeared to give optimum conditions. As the adults emerged or the larvae pupated, the pupal and larval skins were preserved in alcohol; and when they pertained to species it was necessary to study, they were later mounted in balsam for description and drawing. Later on in the investigation, when the larvae and pupae of some of the species were known, it was possible to examine material in the field and bring in larvae and pupae for verification under the microscope.

Species Studied.—During my stay in Honduras, five species of the biting Ceratopogoninae were collected and reared. These are *Culicoides furens Poey*, *Culicoides phlebotomus Will.*, a new species of *Leptoconops*, and two new species of *Culicoides*. The latter three are being described by Dr. W. A. Hoffman in a paper which he is preparing on the two genera involved. One of the new species of *Culicoides* was reared from material brought in from Balsamo Creek, on Balsamo Farm, about 110 kilometers out from Port on the Truxillo Railroad's route to Olanchito. The remaining species were collected and reared from material brought in from the peninsula on which Puerto Castilla is situated—most of them from within a radius of two or three miles from the town. *Culicoides furens*, *C. phlebotomus*, and *Leptoconops* sp. have been recorded as biting persons in the Port itself. *C. furens*, however, is the species which is causing the most trouble in the houses, the offices, and the hospital, as well as outdoors. The species found in the Port may be identified easily if looked at under a hand lens, by means of the following respective characteristics:—

Leptoconops sp. Wings milky white, thorax black, abdomen and legs pinkish yellow to light tan in color.

Culicoides phlebotomus. Wings spotted gray and white, thorax and abdomen dull gray.

Culicoides furens. Wings spotted gray and white, thorax gray with brown spots, abdomen gray.

The species of *Culicoides* at Balsamo also has spotted wings but the thorax is concentrically striped with brown. The other new species of *Culicoides* which was reared from material collected on the northeastern side of the peninsula, is similar to *C. furens* but differs in the distribution of the spots on the thorax and wings. Certain other biting insects are sometimes confused with the sandfly. On some of the farms certain species of *Simulium* are abundant and extremely annoying; these are commonly known there as "bottle" or "botless" flies, and in the United States as "black" flies. Their bite resembles that of the sandfly and may be mistaken for it. Some three or four species were collected at the various farms, and another species near Puerto Castilla. From the habits of the family, I judge that these insects are probably breeding in some of the swifter mountain streams.

Habits of the Adult and Effect of the Bite. — Of the insects in the town, *Culicoides furens* is the most obnoxious. At times it shows an erratic distribution, which may probably be explained in terms of the velocity and direction of the wind, the humidity, protection from the wind, and number of persons present. A study of the effect of the wind velocity on the adults at the hospital has been made at various times. The locality was chosen on account of proximity to the wind gage and to other work in progress, and because of the number of insects which were usually present, if they were anywhere in the Port. The direction and velocity of the wind were noted and an estimate was taken of the number of sandflies present at that time in the northeast corridor of the hospital, by making six sweeps with a fourteen-inch net, killing the insects which were caught, and counting them. An effort was made to take these readings at such times as would furnish an idea of the maximum velocity that would permit the sandflies to come in; hence, the studies do not give any idea of the number of sandflies present when conditions are optimum for their flight. Table 1, below, shows a few typical readings.

TABLE 1

RELATION OF WIND VELOCITY TO NUMBER OF SANDFLIES PRESENT

Date	Time	No. C. furens taken	Wind direction	Wind velocity, *m.p.h.	Previous wind velocity	Remarks
5/31	8.30 A.M.	202	NE	7	Below 3 m.p.h. for 4 hrs.	———
6/1	"	30 (19 with blood)	NE	8	About 3 m.p.h. from 12 to 6 A.M.	More sandflies present earlier.
6/3	"	0	NE	13	Minimum of 9 m.p.h. at 3 A.M.	———
6/5	"	0	E	8	Minimum of 8 m.p.h. NE wind.	At 5 A.M. change of wind to east at 5 m.p.h. from 5 to 6 A.M.
6/7	"	3	W	7	———	Changed from north at 7 A.M.
6/7	4.30 P.M.	20	N	7	———	No natives present.
6/13	8.00 A.M.	23	E	1	Minimum of 7 m.p.h. at 3 A.M.	No natives present. Decreasing wind.

* Miles per hour

The results of this investigation show that: (1) a northeast breeze is more favorable than a west breeze; (2) in the case of the latter, the wind must fall below a velocity of about eight miles per hour and remain there for about three hours or more; (3) insects are present in greater numbers when people are near, but very few insects were taken which showed blood inside; probably they leave as soon as they have finished the meal.

Along the beach and in the swamp the sandflies show a similar irregular distribution. On a windy day they are noticeable in vast numbers in the thick brush, back from the beach, and along the northern edge of the canal, while two or three hundred feet in from the edge of the brush there are few of the insects or none at all. They frequently congregate in the boats of the natives along the beach, and above other damp places that afford shelter from the wind. These two peculiarities at first had a tendency to lead us astray in the search for the breeding places, as material taken where the insects congregated very frequently showed no immature stages present. The same is true of the congregation of the insects about the leaf sheaths of palm trees and other plants that collect water or moisture in their leaf sheaths. In Port, these swarms always consist entirely of females; the presence of males in such a swarm is the indication of a breeding place nearby, as this sex does not fly far from its point of emergence. Both sexes are found near the ground.

Unlike *Culicoides furens*, the females of which seem to fly for some distance in search of blood, *Leptoconops* sp. and *Culicoides phlebotomus* are rarely found except near their breeding place. I have two records of the former species biting a person when inside the house, and once I was myself bitten by *C. phlebotomus* outdoors, while still a considerable distance from any possible breeding place. The other two new species have not been reported as feeding on persons, but they undoubtedly do so. Both were collected by sweeping with a net, and were bred from material brought into the laboratory.

The effect of the bite of the sandfly varies greatly with different people. One species may cause distinct lesions, while on the same person another may not, but the effects of the bite are somewhat more severe in the case of *C. phlebotomus*. The bite is usually accompanied by a pricking sensation, followed by a redness about the point of bite, which later turns into a swelling, causing an intolerable itching that is sometimes present for several weeks. There seems to be, however, some tendency to gain immunity.

Life History and Breeding Places. — In connection with the life history and breeding places, a general description will be given of the type of breeding localities best fitted for each species, and later a description will be given of specific places from which sandflies have been reared, in order that a conception of the habits may better be formed. The larvae and pupae of *Culicoides furens* are found along the edges of pools, in soil that consists generally of about three-fourths sand and one-fourth humus. Occasionally they are found in the bottom of shallow accumulations of water. Usually the water in the pool is brackish;

sometimes it is almost wholly sea water; in several instances it has had greater specific gravity than sea water. Less rarely the larvae and pupae have been taken from the edges of fresh-water pools. On one occasion they were obtained in large numbers from the wet, decaying wood of an old log in the swamp. More rarely they are found in the typical mangrove swamp. The principal breeding place of the sandflies in this region is the area of sand and mud flats across the canal, especially the area northeast and east of the servants' quarters.

Leptoconops sp. usually breeds in the wet area of nearly pure sand, just above high-tide level, along the sides of lagoons and of the canal, where there is little or no wave action. A few *C. furens* larvae are commonly found in these localities.

C. phlebotomus has been reared only from the low, wet depressions, along the sandy beach, which are very rarely flooded because of high tide or wind, but which are near enough the high-tide level to be continually wet. *Leptoconops* sp. also breeds in numbers in such localities.

Culicoides n. sp. no. 1 was reared from sandy mud taken from beside fresh water and slightly brackish pools on the northern side of the swamp. *C. furens* was reared from this same material.

Culicoides n. sp. no. 2 was reared from mud containing decaying leaves and sticks, from along the side of a fresh-water stream.

Descriptions of specific places from which sandflies were reared will perhaps give a better idea of the localities in which they breed. These are given in accordance with the numbers in my notes, and are chosen from among eighty specimens examined.

B 5, B 17, B 20. Material was taken from sandy mud, less than one-eighth humus, from the edge of a pool that was rapidly drying up. This pool is part of a system of lagoons. Material was taken also from four inches under the surface; no insects emerged from this material. From the first three mentioned, *C. furens* and *Culicoides* n. sp. no. 1 emerged.

B 10, B 11. *C. furens* emerged from material composed of decaying leaves, wood, and mud, which was taken from under a mangrove tree, north, and on the opposite edge, from the Spanish school and 200 ft. from the canal.

B 16, B 29. *C. furens* and *Culicoides* n. sp. no. 1 emerged from sandy mud taken from the edge of a fresh-water pool in a coconut pasture, near the end of the nearest path in the rear of the servants' quarters. The pool was overgrown with *Typha*. Acidity Ph. 7.4.

B 30, B 31, B 36. Material was taken from a sink-hole in sand, east of the canal and north of the railroad, and about 200 feet from each. Acidity Ph. 8.4. Specific gravity* 1.035. From one-half teacup of sand, 54 *Leptoconops* and 24 C. *furens* emerged in a month.

B 32, B 42. *C. furens* and *Leptoconops* emerged from nearly pure sand taken from the island on which the oil tank is located. This island is surrounded by the canal and the lagoon, which consist of pure sea-water and are just above sea level at high tide.

---

* Readings were made with a urinometer, on which tap water read about 1.001, and average sea-water near shore 1.025.

B 37, B 57. *Culicoides furens* emerged from sand taken from the sides of a pool on the path through the swamp, about 300 yards behind the laborers' quarters. The soil is two-thirds sand and one-third humus, and the sides are covered with tall ferns. On May 20th, the specific gravity was 1.015, and on June 18th it had increased to 1.032: that is, 7/25 above the specific gravity of sea water.

B 38, 45, 46, 51, 52. *Leptoconops* sp. and *C. phlebotomus* emerged. Material was taken from a wet depression in the sand along the beach, about 15 minutes' walk from Puerto Castilla. No water was present, but the sand was probably saline.

B 40. *C. furens* emerged. Material was taken, at the edge of the canal, from a sand flat that is just above high tide, near the bridge on the side of the canal opposite the hospital.

B 44, 50. *C. furens* and *Leptoconops* sp. emerged. Material was taken from the sides of a cat-tail marsh, near where B 38 was taken. The soil is less than one-sixth humus.

B 49. *C. furens* emerged. Material was taken from near where B 38 was obtained, but the depression had water in it, and *Juncus* and sedges were growing around it.

B 53. *C. furens* emerged. Material was taken from a locality similar to that of B 37, but was 200 feet farther along the path. It is less than one-eighth humus and has a red deposit on top of the sand. Specific gravity 1.042, or 17/25 above that of sea water.

B 54. *C. furens* emerged. Material was taken from north corner of grounds around the servants' quarters, across the canal from the hospital. The soil is one-half humus, and nearby water has a specific gravity of 1.030.

B 55. *C. furens* emerged. Material, which was heavily infested with larvae and pupae, was from the decaying part of a log that was just above the waterline in pool where B 37 was found. In a week 22 males, 10 females, and a number of larvae and pupae were removed. At the end of this time, about half the material was removed and was thoroughly soaked in sea water. The following day 4 males and 1 female emerged. This, together with other evidence, shows that *C. furens* is able to breed in material permeated by sea water.

Food of the Various Species.—In the specimen of the larvae of *Culicoides phlebotomus* that was mounted for study, the alimentary canal was found to be crowded with diatoms. These probably constitute the main food of this species. The food of other species has not yet been ascertained, but it probably consists of decaying vegetable matter and microorganisms.

Description for Field Identification. — A brief description of the larvae for the purposes of field identification may be given as follows:

Leptoconops sp. larvae. Sluggish, often coiling into a circle. Pinkish orange in color. Head encloses a system of black bars and levers for the support of the jaws. Larvae usually remain on the bottom when disturbed. Length about 3.8 mm.

C. furens larvae. When disturbed, they swim rapidly, with spiral, eel-like motions, along the side of the vessel away from the light. Head is light yellow, remainder of body white. Blood-gills are arranged on a dorsal-ventral line. Length about 5.6 mm.

C. phlebotomus larvae. Movements and habits similar to those of *C. furens.* Head brown, body grayish white. Blood-gills more or less radiating in all directions. Length about 6 mm.

A more detailed description of both larvae and pupae will be given in another part of this paper. For field identification the pupae may be described as follows:

Leptoconops sp. pupae. Head and thorax black, abdomen pinkish orange. Breathing-tubes ending in a dark-brown, barrel-shaped structure. Pupae fairly active, always sinking to the bottom of the water when disturbed. Length about 2.2 mm.

C. furens pupae. Brown, with somewhat lighter-colored abdomen. Breathing-tubes somewhat banded, brown and yellow, appearing as if two-jointed. Thorns at apex of abdomen projecting backward at an acute angle from the body. More or less motionless, rising to the top of the water and floating when disturbed. Length 2.8 mm.

C. phlebotomus pupae. Brown, with somewhat lighter-colored abdomen. Breathing-tubes banded, appearing as if three-jointed. Thorns at apex of abdomen projecting at right angles to the main axis of the body. More or less motionless, rising to the top of the water when disturbed. Length 3.3 mm.

Control. — In regard to control, certain additional facts covering life history and habits should be noted. The total length of the life cycle has not been ascertained for any one of the species, but the following notes are interesting in this connection. The adult female of *C. furens* which has been fed on blood has been kept in a vial over moist sand for a period of about seven days. It has been impossible to get her to feed a second time in captivity. Under similar conditions, a female caged in a dry vial will die in a few hours. It seems probable that under field conditions the adults will live at least two weeks. Attempts to get the female to lay eggs have been uniformly unsuccessful. The experiments consisted of placing a number of females in a bottle over damp sand; placing single pairs, male and female, over damp sand and water of various kinds; exposing bottles of damp sand in the swamp for varying lengths of time; and digging holes to clean off an area of infested territory and expose a fresh surface. Material was brought from this last-named area, from time to time, and examined. A specimen that was brought in a month after the hole was dug shows what may be young larvae of *C. furens,* but the time has been too short to rear these to the adult stage. Several times small, white, insect eggs have been noted on material brought in, from which sandflies were later reared, but their connection with the sandflies has not been definitely established.

Larvae have not been secured in their very young stages, but some specimens of the larvae of *C. furens* and *Leptoconops* sp. that are still alive have been under observation for over a month. The length of the pupal stage has been ascertained for the three principal species studied. In all three of these cases, it has lasted for from two to four days, varying somewhat with the specimen involved. In the case of a closely related European species, studied by Patel, the total length of the life history varied from three to twelve weeks. It is very probable that the species here will not differ greatly from this in the length of its life history.

Another fact of importance is the distance that the female will fly from her breeding ground in order to find blood. The best estimate that can be made concerning this is obtainable from the fact that adults of *C. furens* have been taken on an extremely quiet day on the diving platform off shore, a distance of about 2,500 feet from the nearest known or probable breeding place. This may be taken as a minimum estimate of the distance which these insects will fly across an area not affording them protection. In a study of the rate and the locality of breeding, so far as moisture in the soil is concerned, a number of cages were set out on the area of low sand-flat near the oil tank. These cages consisted of half an oil can, with bottom removed, covered with a cloth bag that was supported by stakes outside. The bag was removed and another placed in its stead, and the contents were examined for emerging sandflies. It was hoped that certain of these cages could be used in a study of the effects of certain insecticides, but a high wind at the time of high tide, on two successive days, flooded the cages and reduced the number of insects emerging so that it was impossible to carry out the experiments planned or to start new ones. The emergence records, however, are of interest in connection with the rainfall record and the locality of greatest breeding in relation to moisture; they are given in Table 2, following. A 2 was on the

TABLE 2

SANDFLIES EMERGING FROM CAGES NEAR OIL TANKS

(Cages A 2, A 3, and A 5 set out May 19; cages A 7 to A 11, inclusive, set out May 26)

	Rain-	A 2		A 3		A 5		A 7		A 8		A 9		A 10		A 11	
Date	fall	Lept.	furens	Lept.	furens	Lept.	furens	Lept.	furens	Lept.	furens	Lept.	furens	Lept.	furens	Lept.	furens
May 20		0	0	8	0	0	0										
" 21		1	0	13	0	0	0										
" 26	1.30	1	0	8	0	0	0										
" 31		1	0	53	13	0	0	25	0	14	1	12	1	22	2	13	0
June 1	0.10	2	0		1	0	0	1	0	0	0	0	0	0	0	0	0
" 2		15	0	30	3	1	0	7	0	10	0	10	0	9	3	7	0
All cages except A 5 and A 10 flooded on afternoons of June 3 and 4																	
June 3		3	0	5	1	0	0	1	0	3	0	2	0	0	0	2	0
" 4		0	0	3	0	0	0	0	0	0	0	0	0	2	0	0	0
" 5		0	0	3	0	0	1	0	0	1	1	0	0	2	0	0	0
" 7		0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
" 8		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
" 10		0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0
" 12	0.02	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
" 14		0	1	0	1	0	3	2	1	0	2	0	0	2	0	1	1
Total		23	1	123	19	1	5	37	1	28	4	24	1	39	5	23	1

wettest sand and A 5 on the least wet sand in the area studied. Cages A 3, A 7, A 8, A 9, A 10, and A 11 were all on sand of about the same moisture content, but the amount of vegetation surrounding them varied. It is noticeable that emergence always increased after a rain.

Several measures of protection against the adults are in use in Port, and may be continued with profit. Also certain additional measures may be employed, but it must be remembered that protection against the adult is only a palliative at best—entirely temporary—and that it has little or no effect on the total number of insects breeding and coming into Port. The mosquito bars in use here I have found to be entirely satisfactory for protection against the insect, and the use of the electric fan will also prove a hindrance in regard to the bite of the insect. In rooms and offices that are protected from the wind and where the sandflies tend to accumulate often after they have been blown, or have flown, away from other places, pyrethrum may be burned or a solution of pyrethrum in kerosene may be sprayed, following each day when the sandflies have come in numbers. Pyrethrum powder should be used as for fumigating for mosquitoes, at the rate of one pound of superior-grade pyrethrum powder per 1,000 cubic feet of air space with a three-hour exposure in a tightly closed room. The amount should be proportionately increased in accordance with the increase in leakage. There are on the market a number of commercial preparations consisting largely of an extract of pyrethrum in kerosene, which are effective for spraying corners and other places where sandflies tend to accumulate. Protection can also be secured, in part, in certain rooms by covering the windows with the kind of cloth used for the mosquito bars. It must again be emphasized that measures of this sort must necessarily be only temporary.

For alleviation of the itching caused by the bite, among various things tried, about a seven per cent solution of ammonia water or of wood alcohol has been used with the best success.

With respect to the breeding places, the important facts for consideration will be the length of the life history, distance of travel by the adults, sheltering of the adults from the wind, and protection of adults and immature stages from desiccation. It is necessary to make these factors as unsatisfactory as possible for the breeding of insects. As far as can be ascertained, the best way of accomplishing this consists of a combination of flooding and filling, for a distance of at least a half a mile beyond the canal, of all territory that provides breeding-ground for the insects; together with the removal, so far as possible, of all protection for the adults in this area from either the heat of the sun or the effect of the wind. It seems that the use of an insecticide on such an area would be impracticable, owing to the relative inaccessibility of much of the breeding area. The method proposed is the following: To connect the several deeper lagoons in the swamp by a system of canals three feet or more in depth, and with ample opening to the sea by way of the canal at present in use; then to use the material removed, to build up the remaining area so that it would be two feet or more above high-tide level at the beginning of the dry season. The land thus formed should be as well drained as possible, with the sides made vertical, both along the smaller canals (to be built) and along the canal that now exists here, so that there would be no wet sand or mud flats on which the insects could breed. Both sides of the canal, as well as the filled area, should be kept free of brush and weeds so as to remove all possible shelter for adults flying across. Decaying wood, when situated near the surface of water, should be removed, dried out, and burned. Sand flats containing wet sand, along the beach, in and near the town, and along the canal, should be filled and then protected from subsequent washing out.

If these suggestions are carried out, it will be possible to mount spraying apparatus on a boat and thoroughly treat with a heavy film of crude oil the edges of the canals and the lagoons where the sand is continually wet. This should be done about once a month during dry season; in combination with the other methods suggested, it will eliminate the breeding-ground from the area under discussion. In this connection it should be noted that the following types of localities have not yielded the younger stages of the sandfly: dry sand; seashore that is continually under the action of the waves; forest floor that is covered with decaying leaves even when these are relatively wet; sand that is continually under sea water; water in the leaf sheaths of bromelias, palms, or similar plants; water *per se*, either brackish or fresh.

It seems preferable that in this region the dry season should be chosen for the carrying out of these methods and the elimination of the sandflies, so far as their breeding is concerned. If they are not present during this time of the year, there will be none to breed in the wet season on the town site, even if they have been suspected to have done so in the past. Nevertheless, it would be well, so far as possible, to keep standing water drained off in this area.

To summarize, methods should be effected (1) to create a barrier, or non-breeding zone, by means of flooding and filling an area extending about one-half mile from the canal; (2) to remove brush and weeds that at present provide shelter for the adult, and the area filled should be made as dry and hot as possible; (3) to remove and destroy wet decaying logs which provide a breeding place for the larvae; (4) to remove wet sand-flats along the canal and the beach; (5) to provide the present canal and any subsequently built, as well as the lagoons, with sides as nearly vertical as possible to reduce to a minimum the menace of this breeding place; (6) to treat the sides thus produced with a heavy, unbroken film of crude oil.

PART II

THE EARLY STAGES OF THE BITING CERATOPOGONINAE AT PUERTO CASTILLA, HONDURAS

Five species of the biting Ceratopogoninae have been located and reared from material collected near Puerto Castilla, where certain species are exceedingly annoying. The most common species is *Culicoides furens*, the females of which come into the houses to seek their meal of blood. *Culicoides phlebotomus* and *Leptoconops* sp. are usually found near the damp, sandy ground that is their breeding place, for they never wander far in search of a host. These three species are usually found near salt and brackish water. A species of *Culicoides* which has never been described was reared from material collected on the north side of the swamp near Puerto Castilla. Another undescribed species of *Culicoides* was reared from material collected along Balsamo Creek, about 110 kilometers from Puerto Castilla, along the line of the Truxillo Railroad Company. The last-named species, as well as probably the one before, is entirely a fresh-water type. The adults of the new species are being described by Dr. W. A. Hoffman.

Material for rearing purposes was brought in from the field in Mason fruit-jars, and was covered with a muslin bag. When sandflies were found emerging from this material, a small amount of it was placed in a watch glass, where it was flooded with water, and the larvae and pupae were sorted out. Larvae were transferred to watch glasses, with a little sand for rearing, and pupae were placed on damp sand in vials. The sand in the vials was arranged so as to be slanting, to form a place for the emerging insect to expand. Larval and pupal skins were preserved, mounted in balsam for study.

CULICOIDES FURENS POEY

The larvae burrow in soil which is about one-fourth humus and the remainder sand, and which is situated along the edges of pools of water which may vary from fresh through brackish, to water which has a specific gravity 17/25 more than sea water (1.042). Larvae and pupae have also been found and adults reared from decaying wood of an old, half-submerged log lying in a pool of 1/5 greater density than sea water (1.030).

Larvae.—(Fig. 9)—Length about 5.6 mm.; width about 0.21 mm. for full-grown larva; cylindrical, consisting of 12 segments and head with a collar-like pseudosegment, between the head proper and the first segment. Head lightly chitinized. Hairs on the segments situated as follows: segment 1, one on each side near the anterior border, and one on each side near the middle of the segment; segments 2 to 10 inclusive, one on each side near the anterior border; segment 11, a pair on each side near the anterior border, and one on each side near the posterior border; last segment with two circles of hairs surrounding the apex, the anterior row recurved. The anal segment blunt, with 4 protrusive biramous blood-gills, which are arranged so as to be exserted along the dorsal-ventral midline of the apex of the segment. Hence they are visible from above as a single line, but from the side as a fan, the end members of which are spread at an angle of about 45 degrees when fully extended. Head blunt, oval, truncate behind, the posterior margin a wavy line with two incisions on the ventral side; provided with a number of setae, the position and number of which, like those of the other segments, are difficult to determine. They seem to be arranged in pairs near the lateral margin; on the dorsal side a pair in front of the eyes and two pairs above or behind; on the ventral side 2 pairs approximately below the eyes and a pair near the mouth. Antennae very minute, mandibles sharp without accessory tooth, moving vertically, both labrum and labium slightly projecting. Eyes bilobed, the anterior lobe distinctly smaller, and almost separated from the posterior.

In life the larva is white with a very light-yellow head and black eyes. Its movement, which is typical of the other members of the genus known to me, consists in swimming with a side-to-side motion of the anterior part of the body followed in each case by a similar motion of the posterior part. This is very much like the movement of certain roundworms which also are found in the cultures, and from which the younger stages of the larvae are distinguishable only with difficulty. The larvae are entirely negatively phototropic, seeking the dark side of a dish of water and attempting to crawl out of the dish or burrow into sand or among particles of debris. They are extremely active, and when two species are present at the same time it is difficult to distinguish between them.

CULICOIDES FURENS

Pupae. — *Female* (Fig. 2)—Length 2.8 mm.; width at greatest point, 0.5 mm.; length of respiratory tube, 0.29 mm.; length of last segment, 0.22 mm. Light brown in color, darker toward head and thorax, lighter between segments. Armature of the head inconspicuous, consisting of four small spines (in pairs), each situated on a minute wart. The ventral pair projects downward; the other pair is just in front of the breathing-tube and points anteriorly; the remaining portion of the head is more or less thickly covered with minute, stout spines. The area between the eyes is somewhat raised and minutely spinose. The antennal cases extend slightly beyond the middle of the wing-case and along the anterior border. Mouthparts are broad, as shown in drawing. Antennal, leg, and wing cases are fused to one another and to the thorax, the anterior pair of legs extend nearly to the tip of the wing-cases, with a spine which is directed toward the median line situated about half way down the leg-case and fused entirely with the pupal case; a second pair of leg-cases shows for a short distance between the antennal and the anterior pair of leg-cases; tips of the third pair of leg-cases emerge from beneath the anterior pair and extend slightly beyond the tips of the wing-case, but are not at all recurved. Abdomen has seven segments and part of the eighth shows on the ventral side. Armature is weak, consisting of a series of eight semicircular ridges, centrally tipped, with a weak spine arranged along the posterior margin of most of the segments, lacking or only faintly indicated on the first two and the last two. Dorsum of thorax is dark brown, with a light-colored median stripe where the pupa opens at the time of emergence. Breathing-tubes are cylindrical and very rough with minute warts, attached to the thorax near the head, banded, brown at base, yellow, then brown, then yellow at the tip. Disk of dorsum of thorax has three transverse rows of spine-tipped warts. The first row consists of two relatively larger ones, the others each of four smaller ones, the outer ones of the lower row being minute. Nine visible abdominal segments show on the dorsal side, each with four warts toward the anterior border and 10 minute, semicircular ridges along the posterior border on segments 3 to 7 inclusive, and 2 similar ridges on the 8th segment. The sides of segments 3 to 7, inclusive, have four small, lateral projections, each tipped with a minute spine, 1 on the anterior border and 3 on the posterior border of each segment. On the 8th segment these projections are less conspicuous, on the 9th segment they are quadrate and equipped with 2 large thorns that project laterally and are caudate, diverging from each other at less than an angle of 45 degrees; a short crease extends between these from the dorsal to the ventral side.

Pupae. — *Male* (Fig. 5)—The male is like the female, except that it is more slender, the antennal case is more conspicuous, and the 8th segment is longer and equipped on the ventral side with a forceps-like organ.

LEPTOCONOPS SP.

The larvae are nearly always found burrowing in wet sand mixed with only a little humus, and along the edges of lagoons of sea or brackish water. They are often found also in depressions, along the beach, which are always wet but which are not disturbed by waves.

LEPTOCONOPS N. SP.

Larvae. — (Fig. 7)—Length about 3.8 mm., width about 0.2 mm. (full-grown larvae). The larva is cylindrical, consisting of twelve segments, each segment divided by a circle near the middle, giving the larva the appearance of having twice its actual number of segments. It is entirely without spines or hairs. Posterior end of larva is furnished with three blunt lobes, one dorsal and two ventral. Head is not chitinized, but provided with a system of heavily chitinized rods and levers. Eyes heart-shaped, jaws projecting downward and without accessory teeth.

In life the larvae are pinkish orange in appearance throughout, with the chitinous rods of the head and eyes black. They are sluggish in movement, and when disturbed roll themselves into a perfect circle, remaining in this position for some minutes. They feed with a raking movement of the whole head.

LEPTOCONOPS SP.

Pupae. — *Female* (Fig. 1)—Length 2.2 mm. Width at greatest point across thorax 0.41 mm., length of respiratory tube 0.17 mm., length of last abdominal segment 0.21 mm. Pupae show considerable movement on the surface of the sand, but sink to the bottom when placed in water. In life, the thorax is black, the abdomen from tan to a pink-orange color, with spines that are of darker color. Breathing-tube ends in a dark-brown or black, barrel-shaped structure.

Head is without armature, with only a few very inconspicuous raised places on it, rugose but without spines of any kind, a tubercle extending laterally from the lower one-fourth of the eye-case. Antennae extend across the eyes and down the edge of wing-case to a point slightly above the middle of the wing. Wing-case has the appearance of being crumpled, the legs lying along its anterior edge; the anterior pair and a part of the second pair are out from under the wing-case. The third pair, faintly visible, is entirely enclosed except for the tip, which projects a short distance beyond the edge of the wing and, together with the tips of the wings and other legs, extends free above the base of the abdomen, making the latter appear to be separated from the thorax, when viewed from the side. Abdomen is slender, 8 segments being visible on the ventral side, where each is provided with four spines along the posterior edge; a pair are in the center and are more widely separated on the anterior than the posterior segments, and the other two spines are placed nearer each lateral border. On each side of each segment are a pair of spines, placed close together. On the dorsal surface are six spines, a pair which points backward, one on each anterior angle of the segment, and the other four spaced as on the ventral side. Each spine is situated on a distinct tubercle, and points forward except as otherwise mentioned; on the last segment all spines are lacking, but two thorns project at right angles to the pupa. The next to the last segment lacks the two middle spines, but on it and the two preceding the side ones are longer. The last segment is cleft for little more than one-third of the distance, but the parts are not separated. Dorsum of thorax has 8 low knobs, symmetrically arranged, 4 of them extending across from side to side, with 2 placed anteriorly and 2 placed posteriorly to these. The respiratory tubes consist of conic processes on which are situated barrel-shaped structures bearing the slit-shaped spiracle.

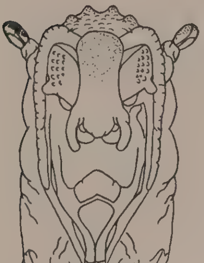
Male (Fig. 4)—The male is similar to the female, but has a thicker antennal sheath and a distinct forceps-shaped structure on the ventral side of the last segment. This segment in the male is shorter than in the female, and less slender.

CULICOIDES PHLEBOTOMUS

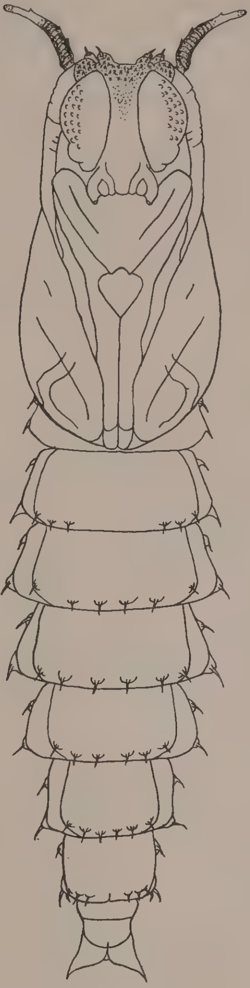
The larvae have been found in, and adults reared from, wet depressions along the beach which are occasionally flooded by sea water, and where the soil is nearly pure sand. Generally there is no water present on the surface.

CULICOIDES PHLEBOTOMUS WILL.

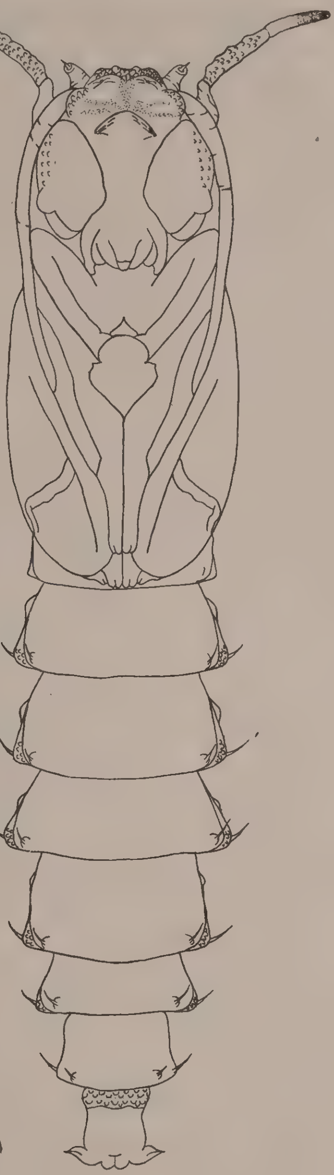
Larvae.— (Fig. 8)—Length about 5.9 mm., width about 0.4 mm. for the full-grown larva; cylindrical, consisting of 12 segments and head, with collar-like pseudosegment between the head proper and the first segment. Head rather heavily chitinized. Setae are present only on the first and last segments, and on the head; on the first segment are 2 pairs, the anterior ones on each side near the anterior-dorsal border of the segment, the second pair on each side situated back



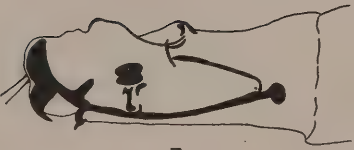
1



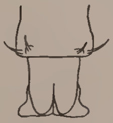
2



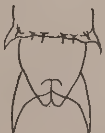
3



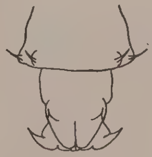
7



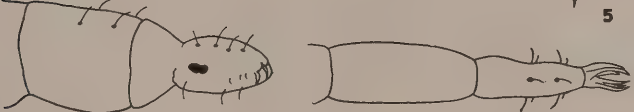
4



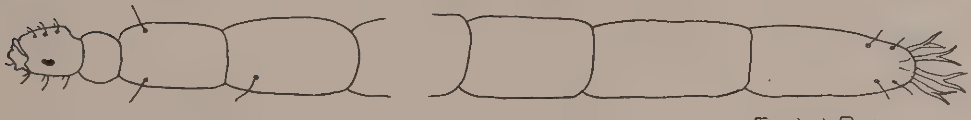
5



6



8



9

Elizabeth Painter.

from the edge of the segment a distance about equal to the length of the pseudosegment. Apical segment with 2 circles of setae, each consisting of 6,—2 ventral, 2 dorsal, and 1 on each side. Apical segment more tapering than in *C. furens,* terminated by 6 protrusive blood-gills arranged in a dorsal-ventral line, but, unlike those of *C. furens,* these gills have a tendency to spread away from this line. Head bears about 10 pairs of setae,—3 small ones on each side situated about half way between the eye spot and the mouth, 3 below this line on each side of the ventral surface, and 4 above on each side of the dorsal surface. Labium and mandibles heavily chitinized, the latter without teeth, antennae minute; mandibles project ventrally and appear to have been rotated from a lateral position and action.

In life the larvae are a grayish white, with brown head capsule and black eyespots. In movement, general appearance, and habits they are much like *C. furens,* negatively phototropic, but with more of a tendency to attempt to burrow into the sand or among the debris in which they are swimming. A mounted specimen shows the alimentary canal filled with shells of diatoms—hence this probably constitutes their main food.

Pupae. — *Female* (Fig. 3)—Length 3.3 mm. Width at greatest point across thorax, 0.7 mm. Length of last segment 0.24 mm. Length of respiratory tube 0.46 mm. Quite similar to *C. furens* in general appearance, but less like it than is *Culicoides* n. sp. no. 1. Thorax brown, abdomen somewhat lighter in color, tip of breathing-tube very dark brown. Top of the head provided with 7 elevations, 2 of which appear to be homologous with anterior spines of *Culicoides furens.* The spines themselves are much reduced, rugose patches over the entire surface; the dorsal pair of spines are well developed and situated farther toward the midline than in *C. furens.* Antennae cross the eyes and reach not quite to the middle of the anterior border of the wing. A protuberance is situated on the eye, about the middle. Mouthparts and legs are situated somewhat as in *C. furens.* Posterior angles of abdominal segments are covered with short, stout knobs, which are quite minute, with a single spine situated among them, somewhat toward the ventral side. A rectangular space is set off on the ventral side of each segment, furnished at the posterior corners with a protrusion and a spine which usually point cephalad. Spines somewhat larger are on the eighth segment. A protrusion is on the lateral border, about midway down the segments 3, 4, 5, and 6. Last segment has anchor-like thorns. Dorsal sides of abdominal segments are similar to ventral, but in addition possess, near the anterior border of each segment, a pair of low knobs and, lateral to each of these, a knob and a spine. The central pair is separated by a distance about equal to the length of a segment. There is a dark brown spot on the anterior ventral border of segments 2 to 6, situated so that it forms the apex of a triangle, the base of which is formed by a line joining the two knobs mentioned above. Dorsum of thorax is rugose, with three rows of transverse warts; the anterior row consists of 2 which are spine-tipped; the second row, of 4 with the inner pair spine-tipped; and the 3rd row, of 2 smooth knobs.

The distinction between the male and the female is similar to that in the case of *C. furens* (Fig. 6).

CULICOIDES N. SP. NO. 1

Adults were reared from soil consisting of sand and humus from the edges of slightly brackish or fresh-water pools. The pupal and larval skins are in too poor a condition to enable one to give a detailed description of them. However, the breathing-tube of the pupa is cylindrical and not rugose, and in the larva the protrusive gills radiate in all directions.

CULICOIDES N. SP. NO. 2

Adults were collected by sweeping along Balsamo Creek. A female was reared from material consisting of mud, decaying leaves, and wood collected along the margin of the creek. A male was reared from a pupa isolated from this material. The description of pupal skin follows.

CULICOIDES N. SP. NO. 2 MALE

Pupae. — Length 3.2 mm. Width across thorax at greatest point, 0.54 mm. Length of last segment, 0.25 mm. Length of respiratory tube, 0.25 mm. Differs from *C. furens* as follows: breathing-tube less rugose, the base brown, a short segment yellow, and the much longer tip brown; each segment of the abdomen surrounded by spine-tipped scallops, 19 in all; on the ventral side there are 3 groups of 3 each, which are obsolete on segments 2, 3, 4, and 9, with 3 groups of 2 each on segment 8; there are 2 groups of 5 each, except on first 2 and last 2 segments; from a dorsal or ventral view, 3 of these spines are visible on each side on the posterior corners of each segment, and about midway down the segment there is a spine situated on a protuberance; dorsum of thorax has 3 lateral rows of spine-tipped warts, the anterior one of 2, the middle of 4, and the last of 2 which are much the smallest.

The usual hosts of the species are possibly the lizards and birds which are common near the places where the insects breed. An individual of a species of rail, which was killed for an examination of its stomach contents, had a female of *Culicoides furens* feeding on it. On the other hand, the lizards probably feed on the sandflies, as do certain dragon flies and an *Empidid* which are common along the edges of the swamps. Two species of *Asilidae* and several *Cicindelidae* which are common along the sea beach are also probably enemies of the sandflies in the adult stage.

In addition to the biting *Ceratopogoninae*, a number of other *Diptera* emerged from the material brought in. These were chiefly *Chironomidae* and *Ephydridae.*

Species of *Stilobezzia*, *Dasyhelea*, *Atrichopogon*, and *Kempia* (genera of *Ceratopogoninae* which rarely, if ever, take mammalian blood) have been reared. On two occasions the carnivorous larvae of species of *Tipulidae* have been isolated and reared. These also undoubtedly feed on the larvae and pupae of *Culicoides furens*, which were present in the same material.

BIBLIOGRAPHY

1. Bequaert, J., Report of an Entomological Trip to the Truxillo Railroad Division, Honduras, to Investigate the Sandfly Problem, 13th An. Rep., Med. Dept., United Fruit Co., 1924
2. Carter, Ingram, and Macfie, "Observations on the Ceratopogonine Midges of the Gold Coast, with Descriptions of New Species," *Ann. Trop. Med. and Parasit.*, Vol. XIV, No. 2, Liverpool, (27 figs. 5 pls.), Nov. 27, 1920, (pp. 187–274)
3. Edwards, F. W., "New and Old Observations on Ceratopogonine Midges Attacking Other Insects," *Ann. Trop. Med. and Parasit.*, Vol. XVII, 1923, (pp. 19–29)
4. Goetghebuer, M., "Metamorphoses et Moeurs du *Culicoides pulicaris*," *Linn. Ann. Soc. Ent. Belgique*, Vol. LIX, 1919, (pp.25–30)
5. Hoffman, W. A., "A Review of the Species of *Culicoides* of North and Central America and the West Indies," *Am. Journ. Hyg.*, Vol. v, No. 3, May, 1925, (pp. 274–301)
6. Lutz, "Brazilian Ceratopogoninae," *Mem. Inst. Osw. Cruz.*, Vol. IV, 1912, (pp. 17–20)
7. McGregor, M. E., "Special Apparatus and Technique for the Study of Mosquitoes and Other Aquatic Insects," *Parasitology*, Vol. XVI, No. 4, Cambridge, 1924, (pp. 388–397)
8. Malloch, J. R., "A Preliminary Classification of Diptera, Based upon Pupal and Larval Characters," Part I, *Bull. Ill. State Lab. of Nat. Hist.*, Vol. XII, Art. III, 1917
9. Patel, P. S., "Note on the Life History of *Culicoides oxystoma*, with Some Remarks on the Early Stages of Ceratopogon," *Proc. 4th Ent. Meet.*, Pusa., 1921, (pp. 272–278)
10. Patten, W. S., "Some Notes on the Arthropods of Medical and Veterinary Importance in Mesopotamia, and Their Relation to Disease," Part IV, *Ind. Journ. Med. Res.*, Vol. VIII, No. 2, Calcutta, Oct., 1920, (pp. 245–256)
11. Rieth, J. T., "Die Metamorphose der Culicoiden," *Arch f. Hydrobiol. Suppl.*, Bd. ii., 1915, (pp. 377–442)
12. Saunders, L. G., "The Life History and the Anatomy of the Early Stages of *Forcipomyia*," *Parasitology*, Vol. XVI, 1924, (pp. 164–213)
13. Senior White, R., "Physical Factors in Mosquito Ecology," *Bull. Ent. Res.*, Jan., 1926, (pp.187–248)
14. Smith, "A Note on a Simple Method of Breeding Sandflies (Phlebotomus)," *Ind. Journ. Med. Res.*, Vol. XII, No. 4, (p. 741)
15. Wherry, E. T., "Soil Acidity and a Field Method for Its Measurement," *Ecology*, Vol. I, (pp. 160–173)
16. Whittingham and Rook, "The Prevention of Phlebotomus Fever," *Trans. Roy. Soc. Trop. Med. and Hyg.*, Vol. XVII, No. 5, London, 1924, (pp. 290–330)

EXPLANATION OF PLATES *

FIG. 1. Pupa of Female *Leptoconops* sp. (ventral view)
FIG. 2. Pupa of Female *Culicoides furens* Poey (ventral view)
FIG. 3. Pupa of Female *Culicoides phlebotomus* Will. (ventral view)
FIG. 4. Last Segment of Male *Leptoconops* sp. pupa (ventral view)
FIG. 5. Last Segment of Male *Culicoides furens* Poey pupa (ventral view)
FIG. 6. Last Segment of Male *Culicoides phlebotomus* Will. pupa (ventral view)
FIG. 7. Head of Larva of *Leptoconops* sp. (lateral view)
FIG. 8. Head and Apical Segments of *Culicoides phlebotomus* (lateral view)
FIG. 9. Head and Apical Segments of *Culicoides furens* Poey (lateral view)

*Drawings made with the aid of a micrometer grating

EQUINE TRYPANOSOMIASIS IN COLOMBIA

(Rengera or Derrengadera)

H. C. CLARK, M.D.
New York, N. Y.

No serious epidemic disease of domestic animals has been called to our attention during the year in any of the divisions except Colombia. During my visit there, I accepted an invitation to investigate the cause of a disease occurring among the horses and mules.

A serious horse disease which had been present for several months had first appeared in the stock in the remote parts of the plantations. It seemed to have gained entrance to the division from the town of Fundacion, which is the terminal railroad station of the fruit zone. Since January, 1926, animals had been dying from this cause in increasing numbers until, by March, the disease had assumed epidemic proportions in the districts of Aracataca, Tucurinca, and Sevilla. The local name applied was *rengera.* During the month of March a local superintendent instituted treatment of the sick animals with *Bayer 205.* The results were good.

The history of the epidemic, the course of the disease, and its apparent cure with the drug mentioned suggested to me equine trypanosomiasis. As some highly resistant animals can survive the acute period of an epidemic and remain dangerous chronic cases, capable of spreading the disease to new horses recruited for the districts, it seemed wise to examine all of our horses and mules in the affected localities. Accordingly, assisted by the local superintendents, I made a microscopic blood survey, using the thick film method. The results of this work, done during the last ten days of July, are tabulated below:

ANIMALS EXAMINED, BY DISTRICTS

Animals	Town of Santa Marta	Town of Rio Frio	Districts of Sevilla-Tucurinca	Districts of Aracataca-Santa Ana	Totals
Mules	13	17	55	77	162
Asses	0	5	0	76	81
Horses	12	9	15	91	127
Dogs	0	9	0	1	10
Totals	25	40	70	245	380

PARASITES FOUND

Animals	Positive for Trypanosomes	Positive for Piroplasma
Horses	5 (3.9%)	10 (7.8%)
Mules	0	3 (1.8%)
Dogs	0	7 (70%)
Totals	5	20

The horse and the dog species of piroplasmata found here need not receive serious attention, because these animals are only chronic carriers of the disease, and native-born animals bear it very well. They are not apt to suffer from an acute attack unless their vitality is lowered by some other disease, or by starvation or injury. An imported horse or dog from a "non-tick" belt may suffer seriously from piroplasmosis, but mules and asses seem to be very little affected.

The trypanosome responsible for the disease *rengera* was found in only five animals, and they were all members of the working herd of horses attached to the Aracataca office. All of them were in use as saddle horses, at the time of the blood survey, and two of them were the property of private owners, who used them while performing their duties as Company employees.

Equine trypanosomiasis, locally known as *rengera*, is a serious horse disease. It has been known to exist in sub-equatorial South America, Venezuela, and Panama for a long time and has been a serious problem in Africa and Asia. As a trypanosomal infection it was reported by Elmassion[1] (1901) in Argentina and soon afterward in other neighboring countries. Rangel[2] reported its aetiological nature (1905) in Venezuela, and Darling[3] (1910) in Panama. Probably it exists in all the South American countries, but at present there are no scientific records to prove this. A different lay name has been applied to the disease in almost every country in which it occurs, and such variety of nomenclature causes confusion. Some of the more common terms applied are the following: Argentina, *mal-de-caderas;* Venezuela, *derengadera* and *peste boba;* Panama, *murrina;* Colombia, *rengera;* northern Africa and southern Europe, *dourine;* southern Africa, *nagana;* French Africa, *Senegambian disease;* and southeastern Asia, *surra.* The trypanosome found in this survey corresponds to *Trypanosoma hippicum* described by Darling[3].

I have never seen a naturally acquired infection in dogs, but they, as well as guinea pigs, rats, mice, and monkeys, can readily be given the disease in a laboratory. Although I have examined many species of wild animals in Panama, I have never found this parasite in any of them under natural conditions. It is said to occur, however, in chiguires (*Hydrochoerus capivara*) and certain foxes and monkeys. The important animal reservoir, so far as we are concerned, is the horse with enough resistance to carry the disease for many months. Such animals may not for a long time show very evident signs of illness, and yet they supply the horsefly with the parasites that are required for the spread of the disease.

The species of horsefly credited with being the insect vector in Venezuela is *Tabanus importunus* Wiedemann[2]. Many important mechanical conveyors of the disease also exist. Any species of fly, while its legs are still wet with blood from a sore or wound on an infected animal, can easily implant the disease on a sore or wound of another animal. Saddles, bridle bits, harness, ropes, etc., that have been in contact with such sores, are also potential conveyors.

I once artificially infected an American mule and, by daily microscopic examinations of its blood, found it positive for the disease almost three weeks before the stable boys in charge of the animal had reason to report it as sick. Such a fact has an important bearing on the management of an epidemic, because it is very necessary to make a blood-film survey of all animals in a herd as soon as it is known that a member of the herd has the disease. In most instances this procedure will indicate which animals are infected and will permit the treatment of many cases before symptoms appear. It will also make possible the complete functional recovery of the animals, as well as help prevent the spread of the disease.

Care must be exercised in performing a blood survey on such a herd, or the infection may be transferred from one horse to another by means of the instruments used. Both the wound from which the film was made and the instruments themselves should be disinfected after each film is prepared.

The trypanosomes are abundant in the peripheral blood of an infected animal about every 7 to 10 days, and are much less abundant, or at times even absent, between these paroxysms. A single examination of a herd, therefore, might not identify all the horses carrying the infection. Horses are much more easily affected than mules and asses, but in some epidemics all these animals suffer. Horses treated very late in the course of the disease are apt to remain more or less stiff and crippled after their recovery from the attack.

The use of *Bayer 205* in the acute stage of equine trypanosomiasis is very satisfactory, and it represents the first successful treatment that the writer has seen applied. Contact of the Company animals with so many of the native herds from the villages renders very difficult the exclusion of this infection from our stock. The recourse to *Bayer 205* in the treatment of the epidemic, without a definite knowledge of the cause of the disease, showed fine judgment on the part of the local livestock department.

I have learned, through a special communication, that this disease appeared in the southern part of the Republic of Panama in June of this year (1926), and that in the month of August the most northerly case reported was at a point about fifteen miles above the center of the Canal Zone. So far as I know, it has never been definitely identified and reported from any country north of Panama. The recent development of a system of new roads throughout the Republic of Panama, however, may open new avenues for this disease to invade our divisions in upper Panama and Costa Rica.

REFERENCES

1. Hutyra and Marek, "Pathology and Therapeutics of the Diseases of Domestic Animals," 1916
2. Iturbe, Juan, "Derrengadera—The Effect of 'Bayer 205' on the Trypanosoma Venezuelense," *Proc. Internat· Conf. on Health Problems in Trop. America*, United Fruit Co., Boston, 1924, (pp. 996–1,001)
3. Darling, S. T., "Murrina, a Trypanosomal Disease of Equines in Panama," *Proc. Canal Zone Med. Assoc.*, Vol. III, Part 2, (pp. 47–64)

GENERAL INSTRUCTIONS FOR EMBALMING

Medical Department, United Fruit Company

Embalming is not the recognized method of caring for the dead in most of the countries where our Company operates. Naturally, the undertaking establishments in such countries are not prepared to practice the method and, as our stations do not have access to the services of a professional embalmer, members of our hospital staffs are called on to do this work occasionally. Since not enough experience is furnished for one to become proficient, it is desirable that information be made available concerning the procedure and the necessary supplies. The following instructions are therefore furnished.

Embalming Procedure

Professional embalmers in temperate climates do not embalm a body earlier than from five to eight hours after death. It is advisable, in the Tropics, to embalm sooner than this, but not before the body has become cold, nor before there has been time to drain the blood, as much as possible, from the head, face, and arms. The body, to be embalmed, should be propped up into as near a sitting position as possible, with the head bent forward and the hands crossed over the abdomen, with the tips of the fingers pointing upward. This will favor the draining of the blood out of the head, face, and hands.

In the Tropics, an interval of two hours is usually long enough to permit good drainage from the upper part of the body, and for the body to become cold. If the face needs shaving, this should be done before the body is embalmed.

When ready to begin embalming, select a room with good light and sufficient space to move around without interference. There should be no spilling of embalming fluid, and steps should be taken to prevent the escape to neighboring rooms of odors from embalming fluid and intestinal gases. Almost any room or ship's cabin can be used for the work. A rubber sheet should be spread on the floor and any exposed furniture should be protected.

If necessary, a table can be improvised by using a board 18″ wide by 6′ 6″ long, with chairs to support it. Such a table need not be higher than from 30″ to 36″.

Place the body on the table and use a sand-cushion or a notched piece of wood (4″ x 4″ x 18″) under the neck and occiput. The external orifices, such as the nostrils, mouth, rectum, and vagina, should be packed with cotton or gauze soaked in embalming fluid. A thin pledget of dry cotton can be placed beneath the upper eyelids to keep them in a closed position.

In the case of a man, the right carotid artery is usually employed to receive the embalming fluid, but in the case of a woman or a child it is better to use the axillary artery, since the style of dressing, in these individuals, might leave the embalmer's wound exposed. To expose the right common carotid artery, make an incision about two or three inches long just above and parallel to the upper edge of the collar bone or clavicle. Start the incision at the right side of the windpipe. Cut through the skin, subcutaneous tissue, and fascia and then carefully dissect the underlying tissue down to the artery. Use the end of the forefinger to separate the artery from its bed of tissues, and avoid breaking the small veins, which might cause annoying bleeding and also permit the escape of much embalming fluid later on in the procedure.

Do not become discouraged in the search for the artery, for even skilled embalmers sometimes consume half an hour in locating and exposing it. Always it is in a state of collapse, and can be recognized by rolling it between the finger and thumb when it will give the sensation of a collapsed rubber tube about the size of a small pencil. When you find it, do not attempt to lift it out of the incision until it is entirely free of all adherent tissues. Once you get it free, bring it up, through the incision, on your finger, and pass a wooden tongue-depressor beneath it; then let the artery rest on that until the injection of the fluid is completed. The ordinary wooden tongue-depressor is a little too wide and should have about one-eighth of an inch cut from each side in its middle third. Cut into the artery on its outer edge for about a quarter of its diameter; then insert a grooved director, with its convex side upward, and pass it downward inside the artery for 2 or 3 inches. When the director is in place, roll the artery over so that the hole you have made in its side will appear on top. Pry open the hole sufficiently to pass a canula (about 3 or 4 inches long, with a diameter of about $^{1}/_{8}$ inch) beneath the grooved director, which acts as a guide and prevents the lining of the artery from being pushed ahead to form an obstruction that would interfere with the flow of the injected embalming fluid. The canula should have a shoulder on its other end, to receive and hold the rubber tubing from the syringe.

The Veino aluminum syringe with the Y-shaped canula attachment, or a similar apparatus, can be used to exsanguinate the body, as well as to inject the fluid.

To withdraw the blood, cut the right jugular vein, and then inject warm water through the artery until it begins to run, clear, from the cut end of the vein. Usually from 1 to 4 pints of blood can be expelled in this manner.

Next, mix the contents of one bottle (15 oz.) of embalming fluid (Esco-Ra-Co) with enough luke-warm water to make a half-gallon of the solution. *The fluid to be injected must be warm!* Neglect of this warning may result in the failure of the whole procedure. The embalming fluid may now be injected. One way is to employ the gravity method, using any container with a nozzle at the base to receive the rubber tubing that is attached to the canula in the artery. The container should be placed at the height of 4′ 6″ above the body, to insure that the fluid shall run with enough force. It is usually better to attach, between the artery-canula and the container-canula, the syringe already mentioned, and thus employ syringe pressure as well as gravity. In many cases the entire work can be done easily by gravity, but the work is expedited by using the syringe.

Usually the fluid is introduced at the rate of about 1 quart every 20 minutes. When you see clear embalming fluid escape from the cut ends of the jugular vein, it is time to tie up the severed ends; but continue injecting the embalming fluid through the artery until all parts of the body are hard and fixed. When you have introduced all the fluid required, you must tie off tightly below the cut that you made in the carotid artery. The canula, just removed, should now be directed upward in the carotid artery and a few ounces of embalming fluid should be injected into the right side of the head to insure a good result in this region. At the close of this work, you must also tie off the artery above the cut in its wall.

Now insert a long trochar into the pleural cavities and fill them with embalming fluid, using the syringe as a direct means. Insert the trochar into the abdominal cavity (being sure to empty the gas from the stomach and intestines) and fill it in the same manner with embalming fluid.

Sometimes a body will not receive the fluid well in all parts; it then becomes necessary to take each carotid, axillary, and femoral artery and inject the fluid through all these avenues before a satisfactory result is obtained.

Soon after the injection of the embalming fluid is started, the body should be placed in the position it will occupy in the casket; otherwise this can not later be done. It is always well to keep a small head-rest in place. Tie a bandage around the lower jaw and over the head, to keep the mouth closed, but as soon as the body is well fixed remove the bandage, or it will leave a bad mark along the sides of the face. Another method of closing the mouth is to suture the frenum of the lower lip to the frenum of the upper lip, or to pass a stout ligature between the teeth of the upper and lower jaws.

A body of average size and in good condition will take from 4,000 to 6,000 cc. of fluid in the arterial system, and about 1,000 cc. of fluid in the cavities. The time consumed in embalming a body will vary from 1 to 4 hours. Some bodies are received in such poor condition for embalming that not all regions can be fixed by arterial injection. It then is necessary to do innumerable hypodermic injections of the fluid until all soft parts are fixed.

Wash the body after the embalming is finished, and protect it from rats, insects, etc.

Record the character and amount of embalming fluid used in each case, since it may have a legal bearing in certain instances.

INSTRUMENTS AND MATERIALS REQUIRED

1 Veino aluminum 2-valve syringe, with aluminum piston and 2-way (Y-shaped) canula
1 bottle of 2,000 cc. capacity with attachment at bottom for rubber tubing connection
1 grooved director
2 wooden tongue-depressors

1 sponge
1 scalpel
1 thumb forceps
1 aneurysm hook or needle
2 artery forceps
1 large trochar for chest and abdominal cavities
1 needle, to close skin incision
1 spool of strong coarse linen thread
1 pair of rubber gloves
2 pails or large pans
4 bottles of embalming fluid (ESCO-RA-CO)
1 roll of cotton
1 bandage
1 rubber sheet about 6 x 8 feet

The Veino aluminum two-valve syringe with an aluminum piston and two-way (Y-shaped) canula connection is the apparatus we have selected for our tropical stations and ships. It can be obtained from the Embalmer's Supply Company, Westport, Conn., U. S. A. Any aluminum or hard-rubber apparatus containing the same principles, however, can be substituted.

The embalming fluid that we supply our stations bears the trade-mark (Esco-Ra-Co). This product is obtainable in any quantity, from the company mentioned above, and offers a standard fluid for all stations and ships.

Isolated stations in the Tropics are sometimes out of stock supplies of this character, and under such circumstances it is possible to substitute a fluid by making up one of the old embalming solutions that formerly were in use. The ingredients for one of the best of these are nearly always available. It consists of a stock of arsenic solution, to which formaldehyde and glycerine are added just before using. The following directions may be of service:

COMPOSITION OF STOCK ARSENIC SOLUTION

150 grams of arsenic (arsenious acid, commercial)
150 " " sodium carbonate, C.P.
36 cc. of plain tap water
Mix and boil until it turns pink, and then add water to make up to 3,000 cc.

EMBALMING FLUID

4,000 cc. of formaldehyde (40% commercial)
1,000 cc. of glycerine
5,000 cc. of plain tap water
500 cc. of the stock arsenic solution

Use this fluid as a luke-warm solution for embalming. Some countries raise a legal objection to its use, because it contains arsenic. It is a very satisfactory embalming fluid for the Tropics but may cause embarrassment at times if the body is to be shipped into a country where legal objections exist regarding the use of arsenic.

In frontier stations conditions sometimes exist that make it impossible to find ingredients for any of the usual solutions. Formaldehyde solution (40% commercial) is practically always in the stock of any station. A very good emergency embalming solution can be made from this by using 1 part of formaldehyde to 2 parts of warm water.

SECTION VIII

A Review of "Manson's Tropical Diseases, A Manual of the Diseases of Warm Climates," Edited by Philip H. Manson-Bahr, D.S.O., M.A., M.D., D.T.M. and H. Cantab, F.R.C.P. Lond. Eighth Edition, Revised, William Wood and Company, New York, 1925

A new edition of this long-known standard work on the practice of medicine in the Tropics is always especially looked forward to by clinicians in that part of the world. They have every reason to believe, from past experience, that here they will find in readily accessible form a clear exposition of their many problems, and a relation of the latest discoveries in aetiology and treatment. In this revision, they will not be disappointed.

The section on malaria is full and complete, and the colored plates of the parasites, by J. K. Lund, are remarkably fine—especially that of the quartan, which represents the appearance more typically than the semi-diagrammatic drawings usually employed. The Editor classifies the parasites of subtertian, or aestivo-autumnal, fever as *Laverania malariae,* taking them out of the genus *Plasmodium,* as well as out of the species *falciparum.* With reference to the statement, that J. G. Thomson has shown the so-called parthenogenetic forms of Schaudinn to have been two schizonts, possibly segmenting, in the same erythrocyte, it is the reviewer's recollection that Schaudinn, in his original communication, considered this possibility, and pictured it, as well as a gamete and a segmenting form, in the same place. Only a slight reference to artificial inoculation is given, and no mention is made of successful inoculation in the presence of rather large doses of quinine.

The Editor notes that at present it is generally recognized that blackwater fever is the result of repeated attacks of, or continued infection with, subtertian malaria. The work of the British investigators in determining this important point is mentioned; but, as in previous editions, the much earlier contributions of the American workers in the Canal Zone are overlooked.

In the diagnosis by means of blood examination, the beginner is advised to learn first the appearances in fresh material, before beginning to interpret those stained. This is wise counsel, which unfortunately is all too little heeded today. The thick film is mentioned, and Ross's procedure given. Properly used, this is a very valuable method in the diagnosis of malaria and of other diseases with parasites in the blood, especially in survey work and doubtful cases. The most serviceable thick-film method in use at the present time is that described by Barber and Komp.*

Treatment is dealt with *in extenso*, and ably. All methods of administration of quinine are carefully considered, and indications for each are analyzed in detail. The Editor is partial to the oral exhibition of quinine in liquid form, and gives the following excellent prescription, the efficacy and relative palatability of which the reviewer can testify to:

> An agreeable and efficacious method of prescribing quinine is to give it in an effervescing mixture composed of 10 gr. of quinine hydrochloride and citric acid mixed together in liquid form with ½ oz. of water to which are added 4 gr. of ammonium carbonate and 20 gr. of potassium bicarbonate in powder form. In order to disguise the disagreeable taste of quinine, which is so objectionable to some people, syrup of orange or glycerin (1 dr.) may be added. Quinine is rendered less bitter if dissolved in milk.

In ordinary intermittent fevers, he advises waiting until the rigor and hot stages are over before beginning quinine, and states that in most cases a second paroxysm does not follow. He warns against pills of the sulphate and other insoluble forms, a warning that should be well heeded. More than one death in pernicious cases, as well as the origin of more than one case of chronic relapse, can be attributed to giving such forms of quinine. He advocates the exhibition of quinine in divided but sufficient doses in pregnancy, and declares that the infection itself is more likely to produce abortion than the drug. Any one who has seen the enormous accumulation of parasites in the placenta, at times, will fully concur. He is reserved as to the use of quinine in blackwater fever, and his reasoning on this point is clear. The reviewer ventures to add that, apart from the ever-present possibility of the evil effects of quinine, autopsies in the Canal Zone have shown definitely that early in the attack there is a great destruction of the parasites and the erythrocytes containing them.

Infections due to trypanosomes are fully dealt with. Points of interest are, that in some cases the disease disappears spontaneously; that there is a direct invasion of brain, nerve, and lymph tissue; and that modern methods hold out hope of ultimate therapeutic triumph.

Under leishmaniasis, he classifies kala azar, oriental sore, and espundia, the American type of skin and mucous-membrane infection. The oral and nasal types are rarely seen on the Spanish Main, but the skin sores are met with not infrequently. One of the great conquests in tropical medicine has been the success of antimony compounds in the treatment of these diseases; the therapy is given in detail. In getting material from the cutaneous lesions for diagnosis, he advocates running a fine glass pipette in through the skin, outside the ulcer, so as to obtain serum from beneath it, rather than scraping or curetting the edges. X-ray treatment, properly applied, is highly recommended, especially for cosmetic reasons. He states that the rays act directly on the Leishman-Donovan bodies. That this treatment is successful in the hands of a competent operator, the reviewer has personal knowledge, but a severe burn may result from its employment in unskilled hands, and this must ever be kept in mind. Too small a dose will not kill the parasites, and too large a dose will give serious trouble. Full directions are given.

---

* "Some Modifications of the Thick-film Method in the Examination of Blood for Malaria Parasites," Barber, M. A., and Komp, W. H. W., "Proceedings of International Conference on Health Problems in Tropical America," United Fruit Co., Boston, 1924

Regarding the treatment of relapsing fever it is noted that, to prevent recurrence, salvarsan and allied compounds should be given on the rise of the fever.

The Editor uses the term Leptospirosis to include yellow fever, infectious jaundice, and seven-day fever. He accepts without reservation Noguchi's claim to have proved *Leptospira icteroides* to be the causative agent in yellow fever, although he states that its cycle in *Aëdes* (*Stegomyia*) *argenteus* has not yet been observed. It is true that Noguchi has adduced a mass of evidence in support of his claim, but the decisive factors of human inoculation (although volunteers could be found) and the cycle in the mosquito are not as yet forthcoming. Perhaps one of the best arguments in favor of *Leptospira icteroides* as the cause of yellow fever is the reputed efficacy of the vaccine made from it. The reviewer does not feel himself competent to give an opinion on this subject, but as an unbiased listener at the International Conference on Health Problems in Tropical America, held in Kingston, Jamaica, in 1924, he heard capable and experienced students of yellow fever refuse to accept the claim made for *Leptospira icteroides* as being the direct cause of the disease, and their arguments appeared to him not without weight. The proceedings of this Conference, including the abstracted discussions, were published in 1924, and the papers and discussions on yellow fever, to the reviewer's mind, form a most valuable contribution to the literature on tropical medicine.

At the present writing, the best authorities believe that in the Western Hemisphere yellow fever is now limited to a few restricted areas in Brazil.

Seven-day fever closely resembles the "six-day fever," described by Deeks in 1912, which occurred as a small local epidemic in Ancon, C. Z. A peculiar feature of the latter disease was that it started in the lower floor of a two-story screened building used as bachelors' quarters, and attacked nearly every inhabitant of that floor, while those on the upper floor escaped. It occurred sporadically in Ancon and Panama for about eighteen months and then died out, not to return to date.

Plague, cholera, and undulant or Malta fever, are described in detail. The first two have not occurred in the Caribbean littoral for many years, but sporadic cases attributed to the third are reported from time to time.

Chapter XIV, on "Fevers of the Enteric Group," summarizes its subject clearly and efficiently. The sporadic, and occasionally epidemic, occurrence of these fevers is to be borne in mind by the practitioner in the Tropics, whether in the Old or the New World. The differential diagnosis is dealt with briefly, but succinctly and informingly. He notes that the finding of malarial parasites does not exclude the fevers of this group. This fact is sometimes overlooked—owing to the reaction against the "typho-malarial fever" diagnosis of other days—and prolonged typhoid cases are frequently overdosed with quinine, with subsequent cardiac damage.

The fevers due to *Bacillus coli* infection are given only brief mention, and mostly as a terminal incident in debilitated natives. Pyelitis due to this infection is one of the most frequent causes of fever in children, especially in little girls, in Panama and the Canal Zone; in adults it is also a relatively common disease. Whether this is true elsewhere in the Tropics the reviewer cannot say, but if it be true, many cases are not diagnosed nor reported. Intravenous injections of mercurochrome and lavage of the kidneys with the same drug are often efficacious.

In Chapter XVII, "The Diagnosis of Fevers in the Tropics," the Editor calls attention to the frequency of tuberculosis:

> Preceding the diagnosis of tropical antecedents, the commoner causes of pyrexia in temperate countries must constantly be kept in mind. At the outset, every case should be examined from this standpoint. The possibility of *pulmonary tuberculosis* must be kept in mind, and not missed because of the presupposition that *any pyrexia in or from a tropical country is necessarily tropical in origin.*

Even if the quoted paragraph were all that the Editor had wished to say on the subject of tropical fevers, it would still be of more value than a volume on the same subject which did not include this dictum.

Beriberi and pellagra are fully discussed. In the chapter on the latter, the *biological protein value* is clearly explained and a valuable table is given. He states that the first suggestion that pellagra is a disease produced by deficiency in diet was made by Funk in 1913. As a matter of fact, on October 3, 1912, Deeks read a paper before the Southern Medical Society, at Columbia, S. C., U. S. A., in which he definitely placed the blame for this disease on an excess of carbohydrates in the diet, and a deficiency of proteids, fruits, and green vegetables. The paper was published in the *Southern Medical Journal*, Volume VI, No. 7, July, 1913, but that part in which it is stated, "Pellagra is due to autointoxication, the result of carbohydrate fermentation," was published in the *New York Medical Record* of March 23, 1912.

In the treatment of cholera, the following prescription of Tomb, of Bengal, should be of value also in the treatment of cases of food poisoning accompanied by violent vomiting and purging. These are not infrequent in this part of the world:

Spts. aether	30 Min.
Ol. caryoph.	5 "
Ol. cajup.	5 "
Ol. junip.	5 "
Acid sulph. aromat.	15 "

This makes a teaspoonful dose, and should be given in $^1/_2$ oz. of water, every half-hour. Generally not more than 8 or 10 doses are necessary.

The dysenteries are discussed fully, with especial emphasis on treatment. The Editor states that it has long been known that ipecacuanha is the most valuable drug in the treatment of amoebiasis. He discusses emetine and its compounds, as well as yatren, and stovarsol. Attention is called to the toxic effects of emetine. Indeed, even more stress might well be laid on this, for in Tropical America emetine poisoning is frequently seen, and over-dosage is common, sometimes with disastrous results. An excellent diet for the after-treatment of amoebic dysentery is appended, although red meat is left out, and tripe, brains, sweetbreads, chicken, and game are included.

Intestinal amoebiasis due to *histolytica* infection, and not associated with dysentery, is dealt with only under the head of cyst-passers. These are divided into two classes, the *contact*, who has never suffered from amoebic dysentery, and the convalescent cyst-passer, who has recovered clinically from such an attack. It is to be hoped that a future edition will take note of the many forms of gastro-intestinal disturbance which result from this type of intestinal infection in people who are without a past or present history of diarrhoea or dysentery. The reviewer is of the opinion that the time will come when it will be recognized that some forms of amoebic invasion of the large bowel are difficult to cure, and that the lesions many times will not heal entirely, notwithstanding the exhibition of so-called specific treatments. It is the reviewer's belief that the final cure results from a combination of healing of the ulcers and elimination of the parasites from the lumen of the large bowel and its appendages.

The chapter on sprue deserves careful reading. This disease is not uncommonly met with in Central and northern South America. It is endemic in Costa Rica, but autochthonous cases have not been found in Panama and the Canal Zone. The Editor is reserved, and rightly so, as to the aetiological agent. The plate representing the appearance of the tongue in acute and chronic stages is remarkably fine. He considers the milk cure the best treatment.

In his discussion of leprosy the Editor points out that the Wassermann reaction cannot be considered as a guide in differential diagnosis. Lloyd, Muir, and Mitra report that 63 per cent of nodular cases and 27 per cent of anaesthetic cases in adults give positive reactions, against a 14 per cent syphilitic rate in the population.

A thoroughly practical and highly valuable Appendix of 232 pages concludes the book. It includes sections on Medical Protozoology, Medical Helminthology, Medical Herpetology, and Laboratory Methods. These have evidently been prepared for the physician who is unable to devote time to such important correlative branches of tropical medicine, and they well serve the intended purpose. The Appendix is indeed a condensed but complete course in Medical Zoology.

It is no easy task to continue the work so capably begun by Sir Patrick Manson, — that of placing before physicians in the Tropics a text book on the practice of medicine especially devoted to their needs, and to condense into a handy volume all of the important findings of recent years. Osler's "Practice of Medicine" has been justly called the physician's "Bible," his one indispensable book, and this edition of Manson's "Tropical Diseases" is as fairly entitled to the same high tribute from workers in tropical medicine, as also were its predecessors. It well sustains the reputation of its talented Editor, Dr. Philip H. Manson-Bahr, not only as one thoroughly versed in the many aspects of an intricate subject, but also as a physician and diagnostician who in every chapter shows unmistakable evidence of experience and skill in practice, whether in the Tropics or elsewhere. The outstanding features of the book are diagnosis and treatment, and all other material is subservient to these two important factors, which are as necessary to the clinician as they are vital to the patient.

If Dr. Manson-Bahr wishes to add to the valuable service he has rendered the English-speaking physicians in the Tropics, he will arrange with the publishers for a Spanish edition. The value of such a translation can be appreciated only by those who know the paucity, in that language, of any literature on tropical medicine.

W. M. J.

Brief Review of "A Manual of the Parasitic Protozoa of Man,"* by Chas. F. Craig, M.D., M.A. (Hon.); Lieut. Colonel, Medical Corps, U. S. Army, D.S.M.

Dr. Craig has gathered into compact and readily accessible form the important factors dealing with the parasitic protozoa of man. He has purposely omitted, except for closely related forms, the protozoa found in the lower animals, and it is his desire to place before health officers, medical practitioners, teachers, laboratory and research workers, and medical students, a complete manual of its kind. In this purpose the author has succeeded admirably. The style is clear and comprehensive, and in touching upon controversial points he does so briefly, in a way not confusing to either the general reader or the student. Before Dr. Craig's book appeared there was but one work of this kind† in English, and those who have sought fruitlessly in the larger technical works on protozoology for definite information with respect to the genera found in man, are under a debt of real gratitude to Colonel Craig for having in so useful a manner collated his own wide personal experience with that of others.

As is to be expected from one who has devoted so many years to the study of the amoebae of Man, and the malaria parasites, the sections dealing with these protozoa are full and complete. The illustrations are, for the most part, well selected, although the reviewer believes that photomicrographs of amoebae and the plasmodia of malaria rarely are as clear and instructive as are accurate line drawings and colored illustrations. However, a few well-selected photomicrographs might have shown more informing detail, with respect to intestinal ulceration, than the reproduction given on page 55 of Dr. Craig's "Manual."

---

*Published by J. B. Lippincott Co., Philadelphia, 1926, (569 pages)

†"Human Protozoology," Hegner and Taliaferro

On page 5 appears this statement:

> *Endamoeba histolytica*, the cause of amoebic dysentery, secretes a proteolytic enzyme that destroys the tissue cells of its host.

After several years' study of excellent tissue sections, the reviewer is convinced that the exact mechanism by which *histolytica* produces ulceration and abscess formation is not yet satisfactorily explained. It probably consists of a combination of factors.

The author of this "Manual" favors *Endamoeba* rather than *Entamoeba* as a generic name. Since this very important matter of nomenclature should be settled one way or another, to avoid the ever-increasing confusion in the literature, the reviewer would suggest that a restudy of Leidy's *Endamoeba blattae* be undertaken by some one well qualified, to try to ascertain definitely whether this parasite of the cockroach is cogeneric with *E. coli*. No important study of *E. blattae* has been made since that of Mercier in 1910, and many of his observations, as Wenyon notes, are as yet unconfirmed.

Dr. Craig does not believe that the genus *Endolimax* should be recognized, but that *E. nana* should be placed in a subgenus of that name and classified with the *Endamoebae* (*Entamoebae*).

He does not regard its morphology or its history as differing sufficiently from those of the *Endamoebae* to justify placing it in a separate genus. On this point the reviewer is not qualified to write with authority, but his own observations are that *E. nana* is quite distinct, generically, from the amoebae included in the genus *Entamoeba*, especially with respect to nuclear structure.

In the chapter on "Diagnosis of the Parasitic Amoebae of Man," the author makes the suggestion that, in examining fresh material, the iris diaphragm of the substage condenser be as nearly closed as possible, since if it is wide open the amoebae will not be seen. The reviewer prefers as wide a cone of light as possible, and advises lowering and raising the condenser until the best result is found, in order to obtain as much use as possible of the aperture of the objective. It might be noted here that the long focus 4 mm. objectives of 0.65 N.A. are very useful in the examination of fresh specimens, and the reviewer prefers them to those of 0.85 N.A., although the former do show more color fringes. The author also states that an oil-immersion objective is not necessary in the diagnosis of living amoebae. However, its proper use will often resolve a doubtful finding, especially in the study of cysts.

The "Manual" describes in detail parasitic flagellates of the intestine of man. The author is in agreement with the generally accepted belief of those who have worked much with these organisms—namely, that they are not pathogenic. The illustrations of *Giardia* and *Chilomastix* are excellent; the section on *Trichomonas* might well have had a few more.

The vexed problem of *Craigia hominis* is very fully discussed, and the author does not consider as justified the criticisms of those who have not studied this parasite. He considers Professor C. A. Kofoid's confirmation of his work ample evidence as to its authenticity. The solitary drawing illustrating this section is not sufficiently clear to enable the student to form an opinion.

A very interesting chapter deals with the Trypanosomes and the Leishmania. These parasites are known to most American practitioners only through the literature, and it is of advantage to have so clear and concise an account as that which Dr. Craig gives. However, as in the sections on malaria also, it is to be hoped that future editions will have colored plates to illustrate the appearances after eosinate of methylene blue stains have been applied. These appearances can not be satisfactorily shown in photomicrographs and line drawings.

One hundred and fifty-two pages are devoted to the malaria plasmodia, and here are correlated the exceedingly valuable results of many years' special study and observation. They may be read with profit by any one who has to do with malaria, no matter how extensive and varied his experience. The methods of screening, which also constitute valuable data, are explained with precision and should be carefully noted, especially with reference to double doors which open outward, and the placing of wire gauze outside the windows.

Those familiar with Colonel Craig's work in malaria will naturally look in this section for controversial matter, and they will not be disappointed. He still maintains his hypothesis that a form of parasite, resistant to quinine, is produced by the conjugation of two minute ring forms within the erythrocyte; and he controverts the negative view that merozoites or spores do not conjugate, by the evidence that the zoospores of a *Synchytrium* have been observed to conjugate.

Plasmodium falciparum quotidianum and *Plasmodium vivax minutum* are upheld as valid species. Failure of confirmation of the two species by workers in the Canal Zone is attributed to scarcity of these infections in that locality. The author states that he has "examined many hundreds of blood smears from scores of malarial patients in Panama and the Canal Zone" and has found *P. falciparum quotidianum* in but two cases, and *P. vivax minutum* in but one.

In the same section, *P. tenue*, Stephens, 1914, and *P. ovale*, Stephens, 1922, are classified as doubtful species, although the latter is thought to be identical with *P. vivax minutum.*

Fortunately for the clinician, the determination of a particular species of malaria plasmodium is not so important as is the correct identification of the parasite itself, whatever the species may be. The infections that are so heavy as to threaten life are readily determined even by the tyro, provided he is working with a properly stained smear.

The Appendix to the "Manual" contains much useful data, clearly and concisely arranged.

The reviewer notes that the author advocates, in the preparation of material from stools, the use of a platinum loop to make the smears, and cover glasses on which to spread them for stained preparations. Here only, in this review, will he take exception against the author. One who has used a camel's hair brush for spreading the films, and slides instead of cover glasses, for convenience in handling, will find little, if any, future use for the method advocated by the author, but—in all fairness it must be said—not by the author alone.

Dr. Craig's book, as a whole, will be found very useful in the medical libraries of the United Fruit Company. So far as the reviewer knows, there is but one other in English (previously referred to) that sums up the subject so well in the same space. The busy practitioner in the Tropics can never hope to become thoroughly versed in the science of Protozoology; and unless he has colleagues who are thoroughly trained laboratory men, he must depend upon his own knowledge, and his skill in the use of the microscope, not only properly to diagnose and treat a large portion of his medical, and at times surgical, cases but now and then to save life itself. His problems of diagnosis are rarely considered by the protozoologists, and he should be thankful to Colonel Craig for the aid given in this excellent "Manual."

W. M. J.

A Review of "Protozoology," by C. M. Wenyon, C.M.G., C.B.E., M.B., B.S., B.Sc. (Lond.), Two Volumes, William Wood and Company, New York, 1926

With respect to medical protozoology, and the many forms of free-living and parasitic protozoa allied to those which are the causative agents of disease in man, this work is truly encyclopaedic. In the preface Dr. Wenyon takes note of the tendency in recent years to divide protozoology into two sections: one directed chiefly to the study of free-living protozoa, and the other to parasitic forms, especially those that give rise to disease in man and domestic animals. Unfortunately this tendency is not a recent one; it has been well established for many years, and has given rise to errors and confusion, not only on the part of medical men who have come in contact with parasitic protozoa long before these were especially studied by zoologists, but also on the part of the protozoologists themselves, who more than once have interpreted various phases of the life cycle of some organism as separate species. While it is true that much of the fault lies with those of us who, without proper training, have tried to distinguish and identify parasitic protozoa, the protozoologists themselves are not guiltless, as witness, during the past three decades, the lack of attention paid in the text books on protozoology to such organisms as the parasites of malaria, the amoebae of man, and the trypanosomes.

In recent years there have been published excellent treatises and monographs on the protozoa, both in general and in particular, that are parasitic in man. None, however, has hitherto attempted extensively to correlate these protozoa with those found free living, and also those parasitic in animals and other metazoa. The need for such a work has long been recognized, but there are few qualified by experience and ability to perform it. To undertake such a task, one must be a physician and a biologist with years of training, as well as a protozoologist thoroughly familiar with every ramification of this particular branch of science. Finally, one must have more than a working knowledge of cytology and pathology, since the abnormal can never be defined without a proper knowledge of the normal.

Adequately to review this book, or to attempt to criticize it, would presuppose a knowledge on the part of the reviewer or critic in some way corresponding to that of Dr. Wenyon himself. The individual physician, protozoologist, biologist, or pathologist may find particular instances in which he agrees or disagrees with the author, but it would be neither just nor proper for such a one, from the critical viewpoint, to consider the mass of information and detail, the wealth of original research, and the careful analysis of the contributions of others, set forth in these volumes, unless he were prepared to match his own learning with that of the author. There is no phase of protozoal infection of other forms of life, from insect to man, that is not fully dealt with and beautifully and accurately illustrated, while the relation of the parasitic protozoa to the free-living forms is discussed completely and with thorough understanding.

Not only is Dr. Wenyon conversant with his subject and his material, but he possesses a true faculty of imparting his information and opinions to others. If he has written a treatise that will take full rank with the great contributions to scientific literature in general, and to protozoology, especially its medical aspect, in particular, he has done so in a style as graceful as it is intelligible. His pages are complete, without redundancy or repletion, and are a witness to his skill in clothing dry detail in words and phrases readily understood.

In such a work there is, of necessity, controversial matter. Those with whom the author differs cannot but agree that he has given their part equally with his own, in illustrations as well as in the text, and with genuine courtesy and tolerance.

These two volumes summarize, to the beginning of 1926, all of our knowledge of the parasitic protozoa, their relation to their free-living kindred, and their connection with disease. They contain, however, more than a mere summary; their pages are stamped with the individuality of the author, and it is his own opinions, research, and labor that give them their peculiar value.

A work such as this will never be out of date. Perhaps in future generations our descendants will come to other conclusions regarding protozoal life itself and its many manifestations; different ideas as to disease and health may obtain; and the concepts of today may be merely discarded theory in the philosophy of tomorrow. But the written monument that faithfully epitomizes the sum of human knowledge at any given epoch will ever remain of imperishable value for the student and the thinker. It is not a little thing to have erected such a landmark on the long road of scientific history.

W. M. J.

SECTION IX

ORGANIZATION AND VITAL STATISTICS

Scope of Medical Department

Phases of the Work.—The Medical Department functions as regards all conditions pertaining to the prevention of disease and the care of the sick and injured. This work embraces the following phases:

(*a*) In the Tropics, care of employees and their dependents; and of the inhabitants of communities within the limits of, or contiguous to, the plantations when no other medical service is available.

(*b*) On all the Company's steamships, care of passengers and members of the crews.

(*c*) In the Domestic Divisions where the Company maintains medical staffs, dispensary service to employees.

(*d*) Physical examination of prospective salaried employees; and of all steamship crews before they leave the home port, each voyage.

(*e*) Supervision of all matters concerning quarantine and immigration affecting the Company's interests.

(*f*) In the Tropical Divisions, supervision and recommendation in all matters pertaining to sanitation.

(*g*) Sanitation of the Company's steamships.

For the effective performance of these many and varied duties the Company maintains fully equipped hospitals and dispensaries in the Tropical Divisions, and dispensary service with sanitary staffs in the ports of New York, Boston, and New Orleans.

Personnel of the Medical Department

Name	Title	Graduate of
W. E. Deeks, M.D., A.M.	General Manager, New York	McGill University, Montreal, Quebec
R. C. Connor, M.D.	Assistant General Manager, New York	University of Texas, Galveston, Texas
H. C. Clark, M.D.	Director of Laboratories and Preventive Medicine, New York	University of Pennsylvania, Philadelphia, Pa.
F. G. Banting, M.D., LL.D., D.Sc.	Consultant in Metabolism of Tropical Diseases, Toronto	University of Toronto, Ontario
A. Castellani, M.D., C.M.G., F.R.C.P.	Consultant in Tropical Dermatology, London	University of Florence, Italy University of Bonn, Germany
W. M. James, M.D.	Consultant in Tropical Medicine, Panama, R. P.	University of Virginia, Charlottesville, Va.
F. B. Mallory, M.D., A.B., A.M.	Consulting Pathologist, Boston, Mass.	Harvard University, Boston, Mass.
M. J. Rosenau, M.D., A.M.	Consultant in Preventive Medicine and Hygiene, Boston, Mass.	University of Pennsylvania, Philadelphia, Pa.
R. P. Strong, M.D.	Consultant in Laboratory and Medical Research Work, Boston, Mass.	Harvard University, Boston, Mass.

P. F. Murphy, M.D.	Port Medical Officer, New Orleans, La.	Tulane University, New Orleans, La.
P. H. Desnoes, M.D.	Port Medical Officer, New York, N. Y.	Columbia University, New York, N. Y.
J. A. Gatlin, M.D.	Sanitary Inspector, New York, N. Y.	Memphis Hospital Medical College, Memphis, Tenn.
F. X. Crawford, M.D.	Port Medical Officer, Boston, Mass.	Harvard University, Boston, Mass.
Harry Eno, M.D.	District Medical Officers, Cristobal, C.Z. (Samaritan Hospital)	Cornell University (Med. Col.), N. Y. City
S. J. Taylor, M.D.		University of Texas, Galveston, Tex.

Banes Division

Name	Title	Graduate of
J. R. Ariza, M.D.	Superintendent	Havana University, Havana, Cuba
A. F. Ruiz, M.D.	Assistant Superintendent	Havana University, Havana, Cuba
R. A. Hernandez, M.D.	Physician	Indiana University, Indianapolis, Ind.
V. Bustillo, M.D.	Physician	Loyola University, Chicago, Ill.
J. Medrano, M.D.	District Medical Officer	Havana University, Havana, Cuba
T. de la Torre, M.D.	District Medical Officer	University of Maryland, Baltimore, Md.
W. Menk, M.D.	Bacteriologist and Roentgenologist	Hamburg University, Hamburg, Germany
Catharin Cotter, R.N.	Matron	Kings County Hospital, Brooklyn, N. Y.
Ruth E. Pease, R.N.	Nurse	Springfield Hospital, Springfield, Mass.
Juana F. Perez, R.N.	Nurse	Mercedes Hospital, Havana University, Havana, Cuba
Francisca Archer, R.N.	Nurse	Public General Hospital, Kingston, Jamaica
Viola I. Clarke, R.N.	Nurse	Public General Hospital, Kingston, Jamaica
Violet R. Perkins, R.N.	Nurse	Public General Hospital, Kingston, Jamaica
Mabel L. Heron, R.N.	Nurse	Public General Hospital, Kingston, Jamaica

Total Number of Employees, other than Doctors and Registered Nurses—44

Colombia Division

Name	Title	Graduate of
L. M. Drennan, M.D.	Superintendent	Georgetown University, Washington, D. C.
E. I. Salisbury, M.D.	Assistant Superintendent	Jefferson Medical College, Philadelphia, Pa.
J. A. Fontalvo, M.D.	House Physician	Universidad de Bolivar, Cartagena, Col.
Rafael Saenz, M.D.	Assistant House Physician	Jefferson Medical College, Philadelphia, Pa.
A. Rivadeneira, M.D.	District Medical Officer	Universidad Nacional de Bogota, Col.
A. Gonzalez, M.D.	District Medical Officer	Universidad Nacional de Bogota, Col.
J. E. Llinas, M.D.	Assistant House Physician	Universidad Nacional de Bogota, Col.
J. C. Register	Laboratory Technician	
Martha W. Vessels, R.N.	Matron	Capital City School of Nursing, Washington, D. C.
Mary M. Langwill, R.N.	Assistant Matron	Royal Prince Alfred Hospital, Sydney, N.S.W., Australia
Julia M. Daley, R.N.	Nurse	Boston City Hospital, Boston, Mass.
Mary C. Walsh, R.N.	Nurse	St. Joseph Hospital, St. Paul, Minn.
Doris Brandford, R.N.	Nurse	Public General Hospital, Kingston, Jamaica
Mabel M. Willis, R.N.	Nurse	Public General Hospital, Kingston, Jamaica
Eunice Johnson, R.N.	Nurse	Public General Hospital, Kingston, Jamaica
Georgiana Booth, R.N.	Nurse	Public General Hospital, Kingston, Jamaica
Gladys Reid, R.N.	Nurse	Nuttall's Nursing Home, Cross Roads, Jamaica.

Total Number of Employees, other than Doctors and Registered Nurses—97

Costa Rica Division

Name	Title	Graduate of
A. A. Facio, M.D., F.A.C.S.	Superintendent	University of Pennsylvania, Philadelphia, Pa. (Medico-Chirurgical College)
M. D. Rojas, Ph.C., M.D.	Assistant Surgeon	Tulane University, New Orleans, La.
N. Villalobos, M.D.	Physician	University of Pennsylvania, Philadelphia, Pa.
C. M. Jimenez, M.D.	Physician	University of Brussels
F. Zumbado, M.D., B.S.C., M.R.C.S., L.R.C.P.	District Medical Officer	Durham University, Durham, England
R. Marchena, M.D.	District Physician	George Washington University, Washington, D. C.
Louisa Kurath, R.N.	Matron	M. E. Hospital, Philadelphia, Pa.
Agnes M. Steele, R.N.	Nurse	Presbyterian Hospital, New York City
Edith M. Erickson, R.N.	Nurse	St. Mary's Hospital, Rochester, Minn.
Sybil E. Chaplin, E.N.	Nurse	Public General Hospital, Kingston, Jamaica
Josephine W. Shrine, R.N.	Nurse	Public General Hospital, Kingston, Jamaica

Total Number of Employees, other than Doctors and Registered Nurses—94

GUATEMALA DIVISION

Name	Title	Graduate of
N. P. Macphail, M.D.	Superintendent	Aberdeen University, Aberdeen, Scotland
Edward B. Ross, M.D.	Surgeon	Vanderbilt University, Nashville, Tenn.
Ricardo Aguilar, M.D., D.D.S.	Physician	Universidad Central de Tegucigalpa, Honduras, C. A. Strycher Dental School, New York, N. Y.
Franz Weiss, M.D.	Bacteriologist and Roentgenologist	University of Munich, Munich, Germany
Myra Ellerby, R.N.	Matron	Middlesex Hospital, London, England
Mary Douglas, R.N.	Nurse	Malden Hospital, Malden, Mass.
Agnes K. Donegan, R.N.	Nurse	Victoria Hospital, Yorkshire, England
Johanna M. Brosnan, R.N.	Nurse	Hospital St. John & Elizabeth, London, England
Alma C. Jones, R.N.	Nurse	Mountainside Hospital, Montclair, New Jersey
Stella Norton, R.N.	Nurse	American Hospital, Guatemala City
Leonora Ventura, R.N.	Nurse	American Hospital, Guatemala City

TOTAL NUMBER OF EMPLOYEES, OTHER THAN DOCTORS AND REGISTERED NURSES—85

JAMAICA DIVISION

Name	Title	Graduate of
I. W. McLean, M.D.	Superintendent	University of Maryland, Baltimore, Md.
J. G. Moseley, M.D., M.R.C.S., L.R.C.P.	District Physician	University of London, England
C. A. Moseley, M.D.	District Physician	University College Hospital Medical School, London, England
F. R. Evans, M.D.	District Physician	Bellevue Hospital Medical College, New York, N. Y.
A. C. Lushington, L.R.C.S., L.F.P. and S.	District Physician	University of Edinburgh and Glasgow, Scotland

TOTAL NUMBER OF EMPLOYEES, OTHER THAN DOCTORS—16

PANAMA DIVISION

Name	Title	Graduate of
O. T. Brosius, M. D., D.T.M. and H.	Superintendent	Tufts College Medical School, Boston, Mass. London School of Tropical Medicine, London, England
I. E. Peon, M.D.	Surgeon	Tulane University, New Orleans, La.
H. R. Eichelbaum, M.D.	Physician and Pathologist	University of Berlin, Berlin, Germany
Mae A. Kenney, R.N.	Matron	Worcester City Hospital, Worcester, Mass.
Iris Bean, R.N.	Nurse	St. George Hospital, London, England

TOTAL NUMBER OF EMPLOYEES, OTHER THAN DOCTORS AND REGISTERED NURSES—49

PRESTON DIVISION

Name	Title	Graduate of
J. de la Guardia, M.D.	Superintendent	Jefferson Medical College, Philadelphia, Pa.
P. S. Malaret, M.D.	District Medical Officer	Medico-Chirurgical College, Philadelphia, Pa.
O. Ortiz, M.D.	Physician	Havana University, Havana, Cuba
J. C. Castellanos, M.D.	Physician	Tulane University, New Orleans, La.
W. Cordes, M.D.	Bacteriologist and Roentgenologist	Marburg University, Germany
Sidonia Molino, R.N.	Chief Nurse	Mt. Sinai Hospital, New York, N. Y.
Madolin Johnson, R.N.	Nurse	Roosevelt Hospital, New York, N. Y.
Irene Spratt, R.N.	Nurse	Ottawa Civic Hospital, Ottawa, Canada
Lillian Johnston, R.N.	Nurse	Homoeopathic Hospital, Utica, N. Y.
Flora Jimenez, R.N.	Nurse	Havana University, Havana, Cuba
Margarita Hernandez, R.N.	Nurse	Santo Tomas Hospital Training School, Panama City, Panama
Catherine Clarke, R.N.	Nurse	Kingston General Hospital, Kingston, Jamaica

TOTAL NUMBER OF EMPLOYEES, OTHER THAN DOCTORS AND REGISTERED NURSES—57

TELA RAILROAD COMPANY

Name	Title	Graduate of
R. B. Nutter, M.D.	Superintendent	Tufts Medical School, Boston, Mass.
E. J. Whitaker, M.D.	Physician	University of Iowa, Iowa City, Iowa
A. E. Moure, M.D.	Physician	Sorbonne Medical School, Paris, France
Sylvia Berg, M.D. [redacted]	Roentgenologist and Orthopedic Surgeon	University of Vienna, Vienna, Austria
J. C. McDaniel	Bacteriologist	
M. E. Smith	Laboratory Technician	
Helen Flanagan, R.N.	Matron	Massachusetts General Hospital, Boston, Mass.
Hilda Hagelberg, R.N.	Nurse	Schassburg Hospital, Sievenburgen, Germany
Leonora Hippolyte, G.N.	Nurse	Kingston General Hospital, Kingston, Jamaica
Edith Wolfe, G.N.	Nurse	Kingston General Hospital, Kingston, Jamaica

TOTAL NUMBER OF EMPLOYEES, OTHER THAN DOCTORS AND REGISTERED NURSES—65

TRUXILLO RAILROAD COMPANY

Name	Title	Graduate of
B. M. Phelps, M.D.	Superintendent	Vanderbilt University, Nashville, Tenn.
H. M. Walker, B.A., M.D.	Physician	University of Texas, Galveston, Texas
W. A. Hutchinson, M.D.	Assistant Surgeon	Tulane University, New Orleans, La.
E. W. Davis, B.S., M.D. [redacted]	Physician	Emory University, School of Medicine, Atlanta, Ga.
W. Jantzen, M.D.	Bacteriologist	Kiel University, Germany
Gena H. Robertson, R.N.	Acting Matron	Sarah Leigh Hospital, Norfolk, Virginia
Helen E. Keyser, R.N.	Assistant Matron	St. Vincent Charity Hospital, Cleveland, Ohio
Estelle A. Byron, R.N.	Nurse	Lebanon Hospital, New York, N. Y.
Esther Gomez, G.N.	Nurse	St. Tomas Hospital Training School, Panama City, Panama
Altagracia Barsallo, G.N.	Nurse	St. Tomas Hospital Training School, Panama City, Panama
Rosa M. Batista, G.N.	Nurse	St. Tomas Hospital Training School, Panama City, Panama
Lilla M. Peart, G.N.	Nurse	Kingston General Hospital, Kingston, Jamaica

TOTAL NUMBER OF EMPLOYEES, OTHER THAN DOCTORS AND REGISTERED NURSES—76

SUMMARY OF WORK DONE

	Banes Division		Colombia Division		Costa Rica Division		Guatemala Division	
	M.	F.	M.	F.	M.	F.	M.	F.
PERSONS DEPENDENT UPON THE MEDICAL DEPARTMENT FOR TREATMENT:								
Employees:								
From Temperate Zone	315	3	101	7	173	11	185	10
Others	4,599	79	7,080	251	6,064	293	4,631	130
Non-employees:								
From Temperate Zone	917	389	291	113	47	93	268	237
Others	9,571	11,666	7,328	6,652	2,870	4,232	6,893	5,432
Totals:	T.	O.	T.	O.	T.	O.	T.	O.
Employees	318	4,678	108	7,331	184	6,357	195	4,761
Non-employees	1,306	21,237	404	13,980	140	7,102	505	12,325
TOTAL	1,624	25,915	512	21,311	324	13,459	700	17,086
Passengers on steamships	–	–	–	–	–	–	–	–
Officers, crews and ships' laborers	–	–	–	–	–	–	–	–
TOTAL	–	–	–	–	–	–	–	–
GRAND TOTAL	–	–	–	–	–	–	–	–
PATIENTS TREATED IN HOSPITALS:								
Employees:	M.	F.	M.	F.	M.	F.	M.	F.
From Temperate Zone	136	–	77	1	115	6	147	5
Others	3,399	11	3,376	127	3,692	117	2,403	73
Non-employees:								
From Temperate Zone	21	12	26	13	61	28	134	38
Others	152	350	126	209	771	583	909	446
Total:	T.	O.	T.	O.	T.	O.	T.	O.
Employees	136	3,410	78	3,503	121	3,809	152	2,476
Non-employees	33	502	39	335	89	1,354	172	1,355
GRAND TOTAL	169	3,912	117	3,838	210	5,163	324	3,831
TREATMENTS IN HOSPITAL DISPENSARIES:								
Employees:	M.	F.	M.	F.	M.	F.	M.	F.
From Temperate Zone	1,371	–	231	3	759	15	891	31
Others	11,068	86	29,035	521	14,415	539	5,602	279
Non-employees:								
From Temperate Zone	255	567	31	43	219	100	168	217
Others	3,405	7,621	617	1,723	1,815	2,088	1,096	1,328
Total:	T.	O.	T.	O.	T.	O.	T.	O.
Employees	1,371	11,154	234	29,556	774	14,954	922	5,881
Non-employees	822	11,026	74	2,340	319	3,903	385	2,424
GRAND TOTAL	2,193	22,180	308	31,896	1,093	18,857	1,307	8,305
TREATMENTS IN FIELD DISPENSARIES:								
Employees:	M.	F.	M.	F.	M.	F.	M.	F.
From Temperate Zone	–	–	118	–	104	2	312	4
Others	–	–	27,345	425	5,506	113	8,852	74
Non-employees:								
From Temperate Zone	–	–	–	–	–	–	37	30
Others	–	–	8	29	5	14	471	142
Total:	T.	O.	T.	O.	T.	O.	T.	O.
Employees	–	–	118	27,770	106	5,619	316	8,926
Non-employees	–	–	–	37	–	19	67	613
GRAND TOTAL	–	–	118	27,807	106	5,638	383	9,539

AND VITAL STATISTICS

Jamaica Division		Panama Division		Preston Division		Tela Railroad		Truxillo Railroad		Semi-Total		
M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	Total
73	3	129	6	290	9	213	14	230	12	1,709	75	1,784
9,294	1,600	2,767	190	5,678	120	3,292	131	4,332	119	47,737	2,913	50,650
35	54	14	40	123	147	16	46	32	65	1,743	1,184	2,927
4,645	6,960	1,721	2,011	3,940	4,789	686	1,268	712	1,627	38,366	44,637	83,003
T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	
76	10,894	135	2,957	299	5,798	227	3,423	242	4,451	1,784	50,650	52,434
89	11,605	54	3,732	270	8,729	62	1,954	97	2,339	2,927	83,003	85,930
165	22,499	189	6,689	569	14,527	289	5,377	339	6,790	4,711	133,653	138,364
–	–	–	–	–	–	–	–	–	–	–	–	54,603
–	–	–	–	–	–	–	–	–	–	–	–	30,793
–	–	–	–	–	–	–	–	–	–	–	–	85,396
–	–	–	–	–	–	–	–	–	–	–	–	223,760
M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	
18	–	111	–	68	–	121	3	142	4	935	19	954
18	1	1,819	104	2,119	23	2,263	31	2,027	32	21,116	519	21,635
23	1	12	18	20	23	88	95	24	23	409	251	660
3	2	272	544	144	232	286	670	150	312	2,813	3,348	6,161
T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	
18	19	111	1,923	68	2,142	124	2,294	146	2,059	954	21,635	22,589
24	5	30	816	43	376	183	956	47	462	660	6,161	6,821
42	24	141	2,739	111	2,518	307	3,250	193	2,521	1,614	27,796	29,410
M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	
411	9	1,127	57	591	–	2,383	204	941	44	8,705	363	9,068
3,736	590	6,441	629	8,928	356	7,882	383	4,678	172	91,785	3,555	95,340
602	166	123	398	104	201	637	1,166	121	244	2,260	3,102	5,362
962	900	1,343	2,882	2,893	5,855	1,197	2,312	390	940	13,718	25,649	39,367
T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	
420	4,326	1,184	7,070	591	9,284	2,587	8,265	985	4,850	9,068	95,340	104,408
768	1,862	521	4,225	305	8,748	1,803	3,509	365	1,330	5,362	39,367	44,729
1,188	6,188	1,705	11,295	896	18,032	4,390	11,774	1,350	6,180	14,430	134,707	149,137
M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	
260	–	213	4	2	–	628	6	280	–	1,917	16	1,933
13,018	4,595	6,270	517	123	–	12,217	74	6,487	55	79,818	5,853	85,671
6	4	1	8	–	–	–	6	2	4	46	52	98
1,253	1,357	110	447	3	37	42	135	69	207	1,961	2,368	4,329
T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	
260	17,613	217	6,787	2	123	634	12,291	280	6,542	1,933	85,671	87,604
10	2,610	9	557	–	40	6	177	6	276	98	4,329	4,427
270	20,223	226	7,344	2	163	640	12,468	286	6,818	2,031	90,000	92,031

SUMMARY OF WORK DONE

	Banes Division		Colombia Division		Costa Rica Division		Guatemala Division	
	M.	F.	M.	F.	M.	F.	M.	F.
TOTAL NUMBER OF TREATMENTS IN HOSPITAL AND FIELD DISPENSARIES:								
Employees:								
From Temperate Zone	1,371	–	349	3	863	17	1,203	35
Others	11,068	86	56,380	946	19,921	652	14,454	353
Non-employees:								
From Temperate Zone	255	567	31	43	219	100	205	247
Others	3,405	7,621	625	1,752	1,820	2,102	1,567	1,470
Total:	T.	O.	T.	O.	T.	O.	T.	O.
Employees	1,371	11,154	352	57,326	880	20,573	1,238	14,807
Non-employees	822	11,026	74	2,377	319	3,922	452	3,037
GRAND TOTAL	2,193	22,180	426	59,703	1,199	24,495	1,690	17,844
NUMBER OF HOSPITAL DAYS:								
Employees:	M.	F.	M.	F.	M.	F.	M.	F.
From Temperate Zone	1,086	–	2,008	6	2,075	50	1,449	20
Others	27,510	86	54,900	1,365	42,354	732	29,699*	843
Non-employees:								
From Temperate Zone	199	94	475	129	1,504	359	1,499	607
Others	2,092	3,152	1,699	2,901	9,392	5,494	7,486	3,045
Total:	T.	O.	T.	O.	T.	O.	T.	O.
Employees	1,086	27,596	2,014	56,265	2,125	43,086	1,469	30,542
Non-employees	293	5,244	604	4,600	1,863	14,886	2,106	10,531
GRAND TOTAL	1,379	32,840	2,618	60,865	3,988	57,972	3,575	41,073
NUMBER OF TREATMENTS ABOARD PASSENGER STEAMSHIPS	–	–	–	–	–	–	–	–
NUMBER OF TREATMENTS BY PORT MEDICAL OFFICERS	–	–	–	–	–	–	–	–
NUMBER OF SEAMEN AND APPLICANTS EXAMINED BY PORT MEDICAL OFFICERS	–	–	–	–	–	–	–	–

	Banes Division	Colombia Division	Costa Rica Division	Guatemala Division
DEATHS, HOSPITALS:				
Employees:				
From Temperate Zone	5	1	2	2
Others	50	74	60	46
Non-employees:				
From Temperate Zone	4	–	2	1
Others	34	21	24	45
Total:				
Employees	55	75	62	48
Non-employees	38	21	26	46
GRAND TOTAL	93	96	88	94
DEATHS, HOSPITAL DISPENSARIES:				
Employees:				
From Temperate Zone	–	–	–	–
Others	2	4	1	–
Non-employees:				
From Temperate Zone	–	–	–	–
Others	8	5	–	–
Total:				
Employees	2	4	1	–
Non-employees	8	5	–	–
GRAND TOTAL	10	9	1	–

*Including 1,355 days from Bobos Sick Camp

AND VITAL STATISTICS—*Continued*

Jamaica Division		Panama Division		Preston Division		Tela Railroad		Truxillo Railroad		Semi-Total		Total
M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	
671	9	1,340	61	593	–	3,011	210	1,221	44	10,622	379	11,001
16,754	5,185	12,711	1,146	9,051	356	20,099	457	11,165	227	171,603	9,408	181,011
608	170	124	406	104	201	637	1,172	123	248	2,306	3,154	5,460
2,215	2,257	1,453	3,329	2,896	5,892	1,239	2,447	459	1,147	15,679	28,017	43,696
T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	
680	21,939	1,401	13,857	593	9,407	3,221	20,556	1,265	11,392	11,001	181,011	192,012
778	4,472	530	4,782	305	8,788	1,809	3,686	371	1,606	5,460	43,696	49,156
1,458	26,411	1,931	18,639	898	18,195	5,030	24,242	1,636	12,998	16,461	224,707	241,168
M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	
210	–	1,099	–	736	–	958	9	1,338	39	10,959	124	11,083
253	14	21,007	1,104	23,198	232	28,726	287	28,517	399	256,164	5,062	261,226
268	40	173	155	240	176	755	1,399	291	244	5,404	3,203	8,607
25	26	3,647	5,826	1,957	2,149	3,945	8,078	2,224	3,187	32,467	33,858	66,325
T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	
210	267	1,099	22,111	736	23.430	967	29,013	1,377	28,916	11,083	261,226	272,309
308	51	328	9,473	416	4,106	2,154	12,023	535	5,411	8,607	66,325	74,932
518	318	1,427	31,584	1,152	27,536	3,121	41,036	1,912	34,327	19,690	327,551	347,241
–	–	–	–	–	–	–	–	–	–	–	–	17,314
–	–	–	–	–	–	–	–	–	–		–	9,748
–	–	–	–	–	–	–	–	–	–	–	–	28,819
–		2		1		–		2				15
–		53		62		42		61				448
1		–		2		2		3				15
–		42		25		34		34				259
–		55		63		42		63				463
1		42		27		36		37				274
1		97		90		78		100				737
–		–		–		–		1				1
3		2		9		–		–				21
–		–		–		–		–				–
–		–		40		–		–				53
3		2		9		–		1				22
–		–		40		–		–				53
3		2		49		–		1				75

SUMMARY OF WORK DONE

	Banes Division	Colombia Division	Costa Rica Division	Guatemala Division
	M. F.	M. F.	M. F.	M. F.
DEATHS, FIELD DISPENSARIES:				
Employees:				
From Temperate Zone	–	–	–	–
Others	–	1	1	1
Non-employees:				
From Temperate Zone	–	–	–	–
Others	–	–	–	–
Total:				
Employees	–	1	1	1
Non-employees	–	–	–	–
GRAND TOTAL	–	1	1	1
DEATHS, HOSPITALS AND ALL DISPENSARIES COMBINED:				
Employees:				
From Temperate Zone	5	1	2	2
Others	52	79	62	47
Non-employees:				
From Temperate Zone	4	–	2	1
Others	42	26	24	45
Total:				
Employees	57	80	64	49
Non-employees	46	26	26	46
GRAND TOTAL	103	106	90	95
DEATHS, STEAMSHIP SERVICE:				
Passengers	–	–	–	–
Officers, crews and ships' laborers	–	–	–	–
TOTAL	–	–	–	–
GRAND TOTAL — DEATHS AMONG PATIENTS TREATED: (Steamship service included)	–	–	–	–
AVERAGE DAILY NUMBER OF PATIENTS IN HOSPITALS:				
Employees:				
From Temperate Zone	2.98	5.53	5.84	4.04
Others	75.81	154.57	118.37	83.90
Non-employees:				
From Temperate Zone	.80	1.66	5.12	5.79
Others	14.41	12.64	40.90	28.93
Total:				
Employees	78.79	160.10	124.21	87.94
Non-employees	15.21	14.30	46.02	34.72
GRAND TOTAL	94.00	174.40	170.23	122.66
AVERAGE DAILY NUMBER OF TREATMENTS IN HOSPITAL DISPENSARIES AND FIELD DISPENSARIES:				
Employees:				
From Temperate Zone	3.77	.97	2.42	3.40
Others	30.64	157.49	56.52	40.68
Non-employees:				
From Temperate Zone	2.26	.20	.88	1.24
Others	30.29	6.53	10.77	8.34
Total:				
Employees	34.41	158.46	58.94	44.08
Non-employees	32.55	6.73	11.65	9.58
GRAND TOTAL	66.96	165.19	70.59	53.66

AND VITAL STATISTICS—*Continued*

Jamaica Division M. F.	Panama Division M. F.	Preston Division M. F.	Tela Railroad M. F.	Truxillo Railroad M. F.	Total
–	–	–	–	–	–
16	–	–	–	–	19
–	–	–	–	–	–
11	–	–	–	–	11
16	–	–	–	–	19
11	–	–	–	–	11
27	–	–	–	–	30
–	2	1	–	3	16
19	55	71	42	61	488
1	–	2	2	3	15
11	42	65	34	34	323
19	57	72	42	64	504
12	42	67	36	37	338
31	99	139	78	101	842
–	–	–	–	–	5
–	–	–	–	–	5
–	–	–	–	–	10
–	–	–	–	–	852
.58	3.02	2.02	2.66	3.78	30.45
.73	60.74	64.37	79.70	79.44	717.65
.85	.90	1.14	5.92	1.47	23.65
.14	26.03	11.28	33.03	14.86	182.21
1.31	63.76	66.39	82.36	83.22	748.10
.99	26.93	12.42	38.95	16.33	205.86
2.30	90.69	78.81	121.31	99.55	953.96
1.87	3.85	1.63	8.85	3.47	30.23
60.27	38.07	25.84	56.47	31.30	497.28
2.14	1.45	.84	4.97	1.02	15.00
12.29	13.14	24.14	10.13	4.41	120.04
62.14	41.92	27.47	65.32	34.77	527.51
14.43	14.59	24.98	15.10	5.43	135.04
76.57	56.51	52.45	80.42	40.20	662.55

SUMMARY OF WORK DONE

	Banes Division	Colombia Division	Costa Rica Division	Guatemala Division
	M. F.	M. F.	M. F.	M. F.
DEATH RATE PER THOUSAND PERSONS DEPENDENT ON THE COMPANY FOR TREATMENT (Steamship employees and passengers not included):				
Employees:				
From Temperate Zone	15.72	9.26	10.87	10.26
Others	11.12	10.78	9.75	9.87
Non-employees:				
From Temperate Zone	3.06	–	14.29	1.98
Others	1.98	1.86	3.38	3.65
Total:				
Employees	11.40	10.75	9.78	9.89
Non-employees	2.04	1.80	3.59	3.59
GRAND TOTAL	3.74	4.86	6.53	5.34
REPATRIATIONS:				
Employees:				
From Temperate Zone	–	–	–	1
Others	8	91	1	–
Non-employees:				
From Temperate Zone	–	–	–	–
Others	–	–	–	–
Total:				
Employees	8	91	1	1
Non-employees	–	–	–	–
GRAND TOTAL	8	91	1	1
AVERAGE NUMBER OF HOSPITAL DAYS ANNUALLY, PER EMPLOYEE:				
From Temperate Zone	3.41	18.65	11.55	7.53
Others	5.90	7.67	6.78	6.42
TOTAL	5.74	7.83	6.91	6.45
HOSPITAL ADMISSION RATE ANNUALLY, PER THOUSAND EMPLOYEES:				
From Temperate Zone	428	722	658	779
Others	729	478	599	520
TOTAL	710	481	601	530
AVERAGE NUMBER DISPENSARY TREATMENTS ANNUALLY, PER EMPLOYEE:				
From Temperate Zone	4.31	3.26	4.78	6.35
Others	2.38	7.82	3.24	3.11
TOTAL	2.50	7.75	3.28	3.24
AVERAGE NUMBER OF EMPLOYEES NON-EFFECTIVE, PER THOUSAND EMPLOYEES:				
From Temperate Zone	9.38	51.22	31.73	20.70
Others	16.21	21.08	18.62	17.62
TOTAL	15.77	21.81	18.99	17.74
AVERAGE NUMBER OF EMPLOYEES PARTIALLY NON-EFFECTIVE, PER THOUSAND EMPLOYEES:				
From Temperate Zone	11.84	8.95	13.14	17.44
Others	6.55	21.48	8.89	8.54
TOTAL	6.89	21.30	9.01	8.89

AND VITAL STATISTICS—*Concluded*

Jamaica Division	Panama Division	Preston Division	Tela Railroad	Truxillo Railroad	Total
M. F.	M. F.	M. F.	M. F.	M. F.	
–	14.81	3.34	–	12.39	8.97
1.74	18.60	12.25	12.27	13.70	9.63
11.24	–	7.41	32.26	30.93	5.12
.95	11.25	7.45	17.40	14.54	3.89
1.73	18.43	11.81	11.50	13.63	9.61
1.03	11.09	7.45	17.85	15.19	3.93
1.37	14.39	9.21	13.76	14.16	6.09
–	–	–	1	–	2
–	4	28	–	3	135
–	–	–	–	–	–
–	1	–	–	–	1
–	4	28	1	3	137
–	1	–	–	–	1
–	5	28	1	3	138
2.76	8.14	2.46	4.26	5.69	6.21
.02	7.48	4.04	8.47	6.50	5.16
.04	7.51	3.96	8.21	6.45	5.19
237	822	227	546	603	535
2	650	369	670	463	427
3	658	362	662	470	431
8.95	10.38	1.98	14.19	5.23	6.17
2.01	4.69	1.62	6.00	2.56	3.57
2.06	4.94	1.64	6.51	2.70	3.66
7.59	22.36	6.76	11.70	15.63	17.07
.07	20.54	11.10	23.28	17.85	14.17
.12	20.62	10.89	22.56	17.73	14.27
24.61	28.51	5.45	38.98	14.36	16.94
5.53	12.87	4.46	16.50	7.03	9.82
5.66	13.56	4.51	17.90	7.41	10.06

RECORD OF

			Banes Division		Colombia Division		Costa Rica Division	
			T.	O.	T.	O.	T.	O.
Remaining from last year	Emp.	M.	1	107	8	156	7	80
		F.	–	–	–	4	–	–
	Non-emp.	M.	1	3	1	3	1	9
		F.	–	6	1	5	2	9
Admitted this year	Emp.	M.	135	3,292	69	3,220	108	3,612
		F.	–	11	1	123	6	117
	Non-emp.	M.	20	149	25	123	60	762
		F.	12	344	12	204	26	574
Discharged	Emp.	M.	135	3,374	73	3,269	110	3,591
		F.	–	11	–	123	6	116
	Non-emp.	M.	20	146	25	122	57	756
		F.	12	347	13	203	26	571
Remaining	Emp.	M.	1	25	4	107	5	101
		F.	–	–	1	4	–	1
	Non-emp.	M.	1	6	1	4	4	15
		F.	–	3	–	6	2	12
Died	Emp.		5	50	1	74	2	60
	Non-emp.		4	34	–	21	2	24
Repatriated	Emp.		–	8	–	88	–	1
	Non-emp.		–	–	–	–	–	–
Total number of hospital days	Emp.	M.	1,086	27,510	2,008	54,900	2,075	42,354
		F.	–	86	6	1,365	50	732
	Non-emp.	M.	199	2,092	475	1,699	1,504	9,392
		F.	94	3,152	129	2,901	359	5,494
Operations with general anaesthesia	Emp.		1	86	2	340	12	140
	Non-emp.		6	100	8	108	20	101
Operations with or without local anaesthesia	Emp.		10	655	16	2,622	72	3,629
	Non-emp.		4	64	9	98	104	1,544

HOSPITALS

Guatemala Division		Jamaica Division		Panama Division		Preston Division		Tela Railroad		Truxillo Railroad		Total		Grand Total
T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	
3	72	2	–	4	56	4	74	6	61	7	72	42	678	720
–	–	–	–	–	4	–	–	–	1	–	6	–	15	15
1	12	–	–	–	2	–	2	3	13	–	3	7	47	54
1	4	–	–	1	11	–	6	2	19	1	3	8	63	71
144	2,331	16	18	107	1,763	64	2,045	115	2,202	135	1,955	893	20,438	21,331
5	73	–	1	–	100	–	23	3	30	4	26	19	504	523
133	897	23	3	12	270	20	142	85	273	24	147	402	2,766	3,168
37	442	1	2	17	533	23	226	93	651	22	309	243	3,285	3,528
146	2,343	18	17	111	1,758	66	2,094	118	2,182	139	1,970	916	20,598	21,514
5	72	–	1	–	101	–	23	3	30	4	30	18	507	525
128	898	22	3	12	268	19	139	80	284	24	140	387	2,756	3,143
37	437	1	2	18	530	23	230	91	653	23	303	244	3,276	3,520
1	60	–	1	–	61	2	25	3	81	3	57	19	518	537
–	1	–	–	–	3	–	–	–	1	–	2	1	12	13
6	11	1	–	–	4	1	5	8	2	–	10	22	57	79
1	9	–	–	–	14	–	2	4	17	–	9	7	72	79
2	46	–	–	2	53	1	62	–	42	2	61	15	448	463
1	45	1	–	–	42	2	25	2	34	3	34	15	259	274
1	–	–	–	–	4	–	28	1	–	–	3	2	132	134
–	–	–	–	–	1	–	–	–	–	–	–	–	1	1
1,449	28,344	210	253	1,099	21,007	736	23,198	958	28,726	1,338	28,517	10,959	254,809	265,768
20	843	–	14	–	1,104	–	232	9	287	39	399	124	5,062	5,186
1,499	7,486	268	25	173	3,647	240	1,957	755	3,945	291	2,224	5,404	32,467	37,871
607	3,045	40	26	155	5,826	176	2,149	1,399	8,078	244	3,187	3,203	33,858	37,061
13	136	–	1	4	117	7	110	11	83	6	66	56	1,079	1,135
29	80	2	–	8	155	10	65	35	64	5	36	123	709	832
24	1,136	1	8	12	1,343	21	1,172	100	1,168	303	2,613	559	14,346	14,905
14	257	2	–	3	300	15	158	224	384	128	1,078	503	3,883	4,386

RECORD OF

			Banes Division		Colombia Division		Costa Rica Division	
			T.	O.	T.	O.	T.	O.
Dispensary treatments	Emp.	M.	1,371	11,068	231	29,035	759	14,415
		F.	–	86	3	521	15	539
	Non-emp.	M.	255	3,405	31	617	219	1,815
		F.	567	7,621	43	1,723	100	2,088
Patients sent to hospital	Emp.	M.	135	3,292	61	1,978	72	2,223
		F.	–	11	1	73	6	61
	Non-emp.	M.	20	149	25	123	58	720
		F.	12	344	12	198	20	522
Visits to lodgings	Emp.	M.	168	415	34	19	43	243
		F.	–	1	2	–	1	41
	Non-emp.	M.	56	293	11	–	7	56
		F.	149	575	44	9	7	102
Operations with general anaesthesia	Emp.		–	–	–	–	1	–
	Non-emp.		–	–	–	3	–	–
Operations with or without local anaesthesia	Emp.		89	2,889	1	920	128	2,957
	Non-emp.		351	6,847	8	74	12	137
Died	Emp.		–	2	–	4	–	1
	Non-emp.		–	8	–	5	–	–
Repatriated	Emp.		–	–	–	3	–	–
	Non-emp.		–	–	–	–	–	–

HOSPITAL DISPENSARIES

Guatemala Division		Jamaica Division		Panama Division		Preston Division		Tela Railroad		Truxillo Railroad		Total		Grand Total
T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	
891	5,602	411	3,736	1,127	6,441	591	8,928	2,383	7,882	941	4,678	8,705	91,785	100,490
31	279	9	590	57	629	–	356	204	383	44	172	363	3,555	3,918
168	1,096	602	962	123	1,343	104	2,893	637	1,197	121	390	2,260	13,718	15,978
217	1,328	166	900	398	2,882	201	5,855	1,166	2,312	244	940	3,102	25,649	28,751
144	2,331	16	18	107	1,763	64	2,045	114	1,071	135	1,955	848	16,676	17,524
5	73	–	1	–	100	–	23	3	27	4	26	19	395	414
133	897	22	3	12	246	20	142	84	265	24	147	398	2,692	3,090
37	442	1	2	17	505	23	226	93	590	22	309	237	3,138	3,375
9	28	82	149	–	–	69	274	118	155	1	–	524	1,283	1,807
–	10	–	41	–	–	–	2	20	18	–	–	23	113	136
2	16	142	16	–	2	9	191	184	63	1	4	412	641	1,053
22	34	33	71	2	4	33	390	283	120	6	–	579	1,305	1,884
–	–	–	–	–	–	–	–	–	–	–	–	1	–	1
–	–	–	–	–	2	–	–	–	–	–	–	–	5	5
35	434	6	124	21	635	46	1,536	175	851	12	440	513	10,786	11,299
6	150	85	1,211	16	434	28	533	228	693	–	54	734	10,133	10,867
–	–	–	3	–	2	–	9	–	–	1	–	1	21	22
–	–	–	–	–	–	–	40	–	–	–	–	–	53	53
–	–	–	–	–	–	–	–	–	–	–	–	–	3	3
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–

RECORD OF

			Banes Division		Colombia Division		Costa Rica Division	
			T.	O.	T.	O.	T.	O.
Number of treatments administered	Emp.	M.	–	–	118	27,345	104	5,506
		F.	–	–	–	425	2	113
	Non-emp.	M.	–	–	–	8	–	5
		F.	–	–	–	29	–	14
Number of surgical treatments			–		9,717		1,500	
Number of medical treatments			–		18,208		4,244	
Total number of treatments			–		27,925		5,744	
Patients sent to hospital	Emp.	M.	–	–	8	1,242	36	1,389
		F.	–	–	–	50	–	56
	Non-Emp.	M.	–	–	–	–	2	42
		F.	–	–	–	6	6	52
Visits to lodgings		M.	–		723		55	
		F.	–		28		3	
Died	Emp.	M.	–	–	–	1	–	1
		F.	–	–	–	–	–	–
	Non-emp.	M.	–	–	–	–	–	–
		F.	–	–	–	–	–	–

FIELD DISPENSARIES

Guatemala Division		Jamaica Division		Panama Division		Preston Division		Tela Railroad		Truxillo Railroad		Total		Grand Total
T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	
312	8,852	260	13,018	213	6,270	2	123	628	12,217	280	6,487	1,917	79,818	81,735
4	74	–	4,595	4	517	–	–	6	74	–	55	16	5,853	5,869
37	471	6	1,253	1	110	–	3	–	42	2	69	46	1,961	2,007
30	142	4	1,357	8	447	–	37	6	135	4	207	52	2,368	2,420
2,980		6,996		1,348		102		3,649		883		27,175		
6,942		13,497		6,222		63		9,459		6,221		64,856		
9,922		20,493		7,570		165		13,108		7,104		92,031		
–	854	1	112	2	1,437	–	2	1	1,131	6	196	54	6,363	6,417
–	11	–	41	–	141	–	–	–	6	–	10	–	315	315
–	1	–	5	–	67	–	–	–	8	–	10	2	133	135
–	7	–	6	–	296	–	–	–	61	–	26	6	454	460
2,240		968		182		4		105		1,942		6,219		
260		664		92		8		9		213		1,277		
–	1	–	12	–	–	–	–	–	–	–	–	–	15	15
–	–	–	4	–	–	–	–	–	–	–	–	–	4	4
–	–	–	3	–	–	–	–	–	–	–	–	–	3	3
–	–	–	8	–	–	–	1	–	–	–	–	–	8	8

DEATHS BY AGE,

Age and Sex		Banes Division				Colombia Division				Costa Rica Division				Guatemala Division				Jamaica Division			
		Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.	
		T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.
Under 1 year	M.	–	–	–	6	–	–	–	4	–	–	–	–	–	–	–	2	–	–	–	2
	F.	–	–	–	2	–	–	–	3	–	–	–	1	–	–	–	–	–	–	–	4
1 to 5 years	M.	–	–	–	2	–	–	–	1	–	–	–	2	–	–	–	1	–	–	–	1
	F.	–	–	–	5	–	–	–	1	–	–	–	–	–	–	–	2	–	–	–	4
6 to 10 years	M.	–	–	–	3	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–
	F.	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–
11 to 20 years	M.	–	9	–	4	–	5	–	4	–	5	–	2	–	7	–	1	–	3	–	–
	F.	–	–	–	5	–	1	–	–	–	–	–	1	–	–	–	2	–	–	–	–
21 to 30 years	M.	2	22	–	2	1	37	–	2	1	13	–	1	–	20	–	6	–	3	–	–
	F.	–	–	–	4	–	–	–	4	–	–	–	4	–	–	–	10	–	–	–	–
31 to 40 years	M.	2	9	2	–	–	22	–	1	–	21	–	1	–	13	–	2	–	3	–	–
	F.	–	–	1	6	–	–	–	4	–	–	1	4	–	–	–	4	–	2	–	–
41 to 50 years	M.	1	8	–	1	–	8	–	2	–	14	–	1	–	4	1	3	–	3	1	–
	F.	–	–	–	–	–	–	–	–	–	–	–	3	–	–	–	2	–	–	–	–
51 to 60 years	M.	–	1	–	–	–	4	–	–	1	5	–	3	1	1	–	5	–	1	–	–
	F.	–	–	–	1	–	–	–	–	–	–	–	1	–	–	–	2	–	–	–	–
61 to 70 years	M.	–	3	–	–	–	1	–	–	–	3	1	–	–	2	–	–	–	2	–	–
	F.	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–
Over 70 years	M.	–	–	1	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	F.	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Unknown	M.	–	–	–	–	–	–	–	–	–	1	–	–	1	–	–	1	–	–	–	–
	F.	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	1	–	–
TOTAL	M.	5	52	3	18	1	78	–	14	2	62	1	10	2	47	1	22	–	15	1	3
	F.	–	–	1	24	–	1	–	12	–	–	1	14	–	–	–	23	–	4	–	8
GRAND TOTAL		5	52	4	42	1	79	–	26	2	62	2	24	2	47	1	45	–	19	1	11

NATIVITY AND SEX

Panama Division				Preston Division				Tela Railroad				Truxillo Railroad				Semi-Total				
Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.		
T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	Total
–	–	–	3	–	–	–	18	–	–	–	2	–	–	–	4	–	–	–	41	41
–	–	–	4	–	–	–	1	–	–	–	4	–	–	–	5	–	–	–	23	23
–	–	–	4	–	–	–	5	–	–	–	3	–	–	–	2	–	–	–	21	21
–	–	–	1	–	–	–	6	–	–	–	4	–	–	–	1	–	–	–	24	24
–	–	–	2	–	–	–	2	–	–	–	–	–	–	–	1	–	–	–	9	9
–	–	–	–	–	–	–	4	–	–	–	1	–	–	1	–	–	–	1	6	7
–	2	–	3	–	9	–	1	–	7	–	1	–	8	–	1	–	55	–	17	72
–	–	–	4	–	–	–	4	–	–	–	2	–	–	–	1	–	1	–	19	20
–	7	–	3	1	34	1	4	–	23	1	2	–	33	–	2	5	192	2	22	221
–	–	–	3	–	–	–	5	–	–	–	4	–	1	–	8	–	1	–	42	43
–	13	–	2	–	12	–	1	–	4	–	3	1	12	–	1	3	109	2	11	125
–	1	–	2	–	–	–	3	–	–	–	4	–	–	–	2	–	3	2	29	34
2	15	–	4	–	9	–	2	–	4	1	–	–	2	–	1	3	67	3	14	87
–	–	–	2	–	–	–	2	–	–	–	2	–	–	–	1	–	–	–	12	12
–	9	–	3	–	6	–	2	–	2	–	–	2	3	1	1	4	32	1	14	51
–	–	–	–	–	–	–	1	–	–	–	1	–	–	–	1	–	–	–	7	7
–	5	–	1	–	1	1	–	–	1	–	–	–	–	–	–	–	18	2	1	21
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	1	2
–	3	–	1	–	–	–	2	–	1	–	–	–	–	–	–	–	5	1	3	9
–	–	–	–	–	–	–	2	–	–	–	–	–	–	–	–	–	–	–	2	2
–	–	–	–	–	–	–	–	–	–	–	1	–	2	1	–	1	3	1	2	7
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2	–	1	–	3	4
2	54	–	26	1	71	2	37	–	42	2	12	3	60	2	13	16	481	12	155	664
–	1	–	16	–	–	–	28	–	–	–	22	–	1	1	21	–	7	3	168	178
2	55	–	42	1	71	2	65	–	42	2	34	3	61	3	34	16	488	15	323	842

DEATHS BY NATIVITY

	Banes Div.	Colombia Div.	Costa Rica Div.	Guatemala Div.	Jamaica Div.	Panama Div.	Preston Div.	Tela Railroad	Truxillo R.R.	Total
NATIVITY:										
Barbadoes	–	–	–	–	–	1	–	–	–	1
British Honduras	–	–	–	1	–	–	–	2	1	4
British West Indies (other than Jamaica and Barbadoes)	–	1	3	–	–	5	–	–	–	9
China	2	–	–	–	–	1	3	1	–	7
Colombia	–	100	2	–	–	2	–	–	–	104
Costa Rica	–	–	34	–	–	8	–	–	1	43
Cuba	50	–	–	–	–	–	68	–	–	118
Dutch West Indies	–	2	–	–	–	–	–	–	–	2
England	–	–	1	–	1	–	–	–	2	4
French West Indies	–	–	–	1	–	3	–	–	–	4
Guatemala	–	–	–	58	–	–	–	2	–	60
Hayti	33	–	1	–	–	–	40	–	–	74
Honduras	–	–	–	16	–	–	–	54	69	139
India	–	–	–	–	4	–	–	–	4	8
Italy	–	–	–	1	–	–	–	–	–	1
Jamaica	7	2	34	6	26	43	22	2	12	154
Nicaragua	–	–	11	–	–	5	–	–	4	20
Panama	–	–	–	–	–	28	–	–	–	28
Porto Rico	2	–	–	–	–	–	1	–	–	3
Roumania	1	–	–	–	–	–	–	–	–	1
Salvador	–	–	–	8	1	1	–	14	4	27
Serbia	–	–	–	–	–	–	1	–	–	1
Spain	8	1	–	–	–	1	3	1	1	15
Spanish Honduras	–	–	1	–	–	–	–	–	–	1
Syria	–	–	1	–	–	–	–	–	–	1
United States	–	–	2	2	–	1	1	1	3	10
Unknown	–	–	–	2	–	–	–	1	–	3
TOTAL	103	106	90	95	31	99	139	78	101	842

CLASSIFICATION OF

	Banes Division				Colombia Division				Costa Rica Division				Guatemala Division			
	Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.	
	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.
ENDEMIC OR INFECTIOUS DISEASES:																
Typhoid fever (abdominal typhoid and paratyphoid):																
Typhoid fever	–	2	1	2	–	2	–	2	–	1	1	3	–	–	–	–
Paratyphoid fever	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–
Malarial fever or cachexia:																
Estivo autumnal	–	9	–	5	–	–	–	–	–	15	–	3	–	4	–	4
Tertian	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2
Quartan	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Mixed	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Clinical	–	–	–	–	–	–	–	–	–	–	–	1	–	1	–	–
Cachexia	–	–	–	–	–	–	–	–	–	1	–	–	–	1	–	1
Hemoglobinuric fever	2	4	1	6	–	1	–	–	1	5	–	1	–	1	–	2
Whooping cough	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Dysentery:																
Amebic	–	1	–	–	1	6	–	–	–	1	–	–	–	–	–	2
Bacillary	–	–	–	1	–	–	–	–	–	1	–	–	–	3	–	2
Unspecified or due to other causes	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Erysipelas	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	1
Epidemic cerebro-spinal meningitis	–	2	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Purulent or septicemic infection	–	–	–	–	–	7	–	1	–	1	–	–	–	6	–	6
Tetanus	–	–	–	1	–	–	–	2	–	1	–	–	–	–	–	–
Tuberculosis of the respiratory system:																
Acute pulmonary tuberculosis	1	2	–	–	–	7	–	2	–	4	–	4	–	4	–	6
Other forms of tuberculosis of respiratory organs	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Tuberculosis of the meninges or of the central nervous system	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Tuberculosis of the intestines or peritoneum	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Tuberculosis of other organs and structures:																
Tuberculosis of other organs	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–
Disseminated tuberculosis:																
Acute (including miliary tuberculosis of the lungs, except that specified as chronic or pulmonary)	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–
Syphilis (includes syphilitic infection of any organ, tissue or structure of the body):																
Secondary	–	1	–	–	–	–	–	–	–	1	–	–	–	–	–	–
Tertiary	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–
Hereditary	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1
Period not specified	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
GENERAL DISEASES NOT INCLUDED ABOVE:																
Cancer or other malignant tumors of the buccal cavity:																
Cancer of the jaw	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Cancer or other malignant tumors of the stomach and liver:																
Cancer of the esophagus	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Cancer of the stomach	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1
Cancer of the liver and gall bladder	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–
Cancer or other malignant tumors of the peritoneum, intestines and rectum:																
Cancer of the intestines (except rectum)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Cancer of the rectum and anus	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Cancer or other malignant tumors of the female genital organs:																
Cancer of the uterus	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1
Cancer or other malignant tumors of other or unspecified organs:																
Cancer of the lungs and pleura	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Benign tumors and tumors not returned as malignant (except benign or non-specified tumors of the ovary and uterus):																
Tumor of brain	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Tumor of other location	–	–	–	–	–	1	–	–	–	–	–	1	–	–	–	–

DEATHS BY DISEASE

Jamaica Division				Panama Division				Preston Division				Tela Railroad				Truxillo Railroad				Semi-total					Deaths in Hospitals			
Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.			Emp.		Non-Emp.	
T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	Total	T.	O.	T.	O.
–	3	–	–	–	1	–	1	–	1	–	1	–	4	1	1	–	–	–	–	–	14	3	10	27	–	11	3	10
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	1	–	–	–	1
–	–	–	–	–	–	–	1	–	14	–	9	–	2	–	1	1	–	–	2	1	44	–	25	70	–	42	–	17
–	–	–	–	–	1	–	3	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	5	6	–	1	–	5
–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	1	–	–	1	–	1	–	–
–	–	–	–	–	1	–	2	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	2	3	–	1	–	2
–	3	–	6	–	–	–	–	–	3	–	2	–	–	–	–	–	1	–	–	–	8	–	9	17	–	2	–	1
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	3	–	1	4	–	3	–	1
–	–	–	–	–	1	–	1	–	1	–	1	–	–	–	–	–	4	–	–	3	17	1	11	32	3	17	1	11
–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	1	1	–	–	–	1
–	–	–	–	–	1	–	1	–	1	–	–	–	2	–	1	–	–	–	–	1	12	–	4	17	1	12	–	4
–	–	–	–	–	–	–	–	–	1	–	1	–	–	–	–	–	–	–	–	–	5	–	4	9	–	5	–	3
–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	2	–	–	2	–	2	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	1	2	–	1	–	1
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2	–	–	2	–	2	–	–
–	–	–	–	–	7	–	–	–	–	–	1	–	1	–	2	–	2	–	2	–	24	–	12	36	–	24	–	11
–	–	–	–	–	–	–	1	–	–	–	–	–	2	–	2	–	–	–	–	–	3	–	6	9	–	3	–	5
–	–	–	–	–	2	–	2	–	11	–	3	–	3	–	2	–	2	–	2	1	35	–	21	57	1	34	–	16
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	1	–	–	1	–	1	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	1	–	1	–	–
–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	1	–	–	–	–
–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	2	–	–	2	–	2	–	–
–	–	–	–	1	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	2	–	–	3	1	2	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2	–	–	2	–	2	–	–
–	–	–	–	–	–	–	3	–	1	–	–	–	1	–	–	–	–	–	–	–	3	–	3	6	–	3	–	3
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	1	–	–	–	1
–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	1	–	1	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	1	–	–	1	–	1	–	–
–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	1	–	–	1	–	1	–	–
–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	1	1	1	3	–	1	1	1
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	1	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	1	1	–	–	–	1
–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	1	–	1	–	–
–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	1	2	–	–	–	1
–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	1	–	–	1	–	1	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	1	1	–	–	–	1
–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	2	–	1	3	–	2	–	1

CLASSIFICATION OF DEATHS

	Banes Division				Colombia Division				Costa Rica Division				Guatemala Division			
	Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.	
	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.
Pellagra	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–
Beri-beri	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–
Diabetes	–	–	–	1	–	–	–	1	–	–	–	–	–	–	–	–
Anemia, Chlorosis:																
Pernicious anemia	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1
Other anemias and chlorosis	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	1
Disease of the spleen	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Leukemia and Hodgkin's disease:																
Leukemia	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–
Alcoholism (acute or chronic)	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–
Other general diseases:																
Autointoxications	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Purpura hemorrhagica	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
DISEASES OF THE NERVOUS SYSTEM AND ORGANS OF SPECIAL SENSE:																
Encephalitis	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–
Meningitis:																
Simple	–	–	–	–	–	3	–	1	–	–	–	–	–	1	–	–
Non-epidemic cerebro-spinal meningitis	–	–	–	–	–	–	–	1	–	–	–	–	–	1	–	–
Other diseases of the spinal cord:																
Myelitis	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Cerebral hemorrhage, apoplexy:																
Cerebral hemorrhage	–	–	–	–	–	2	–	–	–	2	–	–	–	–	–	–
Paralysis (without specified cause):																
Other forms of paralysis	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Other forms of mental alienation	–	–	–	–	–	–	–	–	–	2	–	–	–	–	–	–
Infantile convulsions (under 5 years of age)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Other diseases of the nervous system	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Diseases of the organs of hearing and the mastoid process:																
Diseases of the mastoid process	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
DISEASES OF THE CIRCULATORY SYSTEM:																
Pericarditis	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Acute endocarditis and myocarditis:																
Acute endocarditis	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Acute myocarditis	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–
Angina pectoris	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Other diseases of the heart:																
Chronic endocarditis	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Chronic myocarditis	–	–	–	–	–	1	–	–	–	1	1	–	–	–	–	–
Other chronic diseases of the heart	–	1	–	–	–	–	–	1	1	3	–	1	–	1	–	1
Aneurism	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Atheroma and other diseases of the arteries	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–
Embolism and thrombosis (except cerebral)	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–
Hemorrhage without determined cause; other diseases of the circulatory system	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–
DISEASES OF THE RESPIRATORY SYSTEM:																
Diseases of the larynx (except tuberculosis and cancer)	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–
Bronchitis:																
Acute	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Broncho-pneumonia (including capillary bronchitis):																
Broncho-pneumonia	2	2	–	7	–	5	–	2	–	3	–	1	–	3	–	–
Pneumonia:																
Lobar	–	18	1	3	–	21	–	–	–	–	–	1	–	13	–	9
Not otherwise specified	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–
Pleurisy:																
Empyema of thoracic cavity	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–

BY DISEASE—*Continued*

Jamaica Division				Panama Division				Preston Division				Tela Railroad				Truxillo Railroad				Semi-Total					Deaths in Hospital			
Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.			Emp.		Non-Emp.	
T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	Total	T.	O.	T.	O.
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	1	–	–	–	1
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	1	–	1	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2	2	–	–	–	2
–	–	–	–	–	–	–	–	–	–	–	1	–	1	–	–	–	–	–	–	–	1	–	2	3	–	1	–	1
–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	2	–	1	3	–	2	–	1
–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	1	1	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	1	–	–	–	1
–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	1	–	–	1	2	1	–	–	1
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	1	–	–	1	–	1	–	–
–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	1	–	–	1	–	1	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	2	–	–	2	–	2	–	–
–	–	–	–	–	1	–	–	–	–	–	–	–	1	–	–	–	1	–	–	–	7	–	1	8	–	7	–	1
–	–	–	–	–	–	–	3	–	1	–	–	–	2	–	4	–	2	–	2	–	6	–	10	16	–	6	–	10
–	–	–	–	–	2	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	2	–	1	3	–	2	–	1
–	1	–	–	–	3	–	1	–	1	–	–	–	1	–	–	–	–	–	–	–	10	–	1	11	–	9	–	1
–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	1	1	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2	–	–	2	–	2	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	1	1	–	–	–	1
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	1	–	1	–	–	1	–
–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	1	–	–	1	–	1	–	–
–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	1	–	1	–	2	–	1	3	–	2	–	1
–	–	–	–	–	–	–	–	–	2	–	–	–	1	–	–	–	–	–	–	–	3	–	–	3	–	3	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	2	–	–	2	–	2	–	–
–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	1	–	–	–	1
–	–	–	–	–	–	–	1	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	2	2	–	–	–	1
–	1	–	–	–	2	–	1	–	–	–	1	–	–	–	1	–	2	–	–	–	7	1	3	11	–	6	1	2
–	–	–	–	–	2	–	–	–	7	–	1	–	–	–	–	–	2	–	–	1	16	–	4	21	1	14	–	4
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	1	–	–	1	–	1	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	1	–	1	–	–
–	–	–	–	–	1	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	2	–	1	3	–	2	–	1
–	–	–	–	–	1	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	2	–	1	3	–	2	–	1
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	1	–	1	–	–
–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	1	1	–	–	–	–
–	–	–	–	–	–	–	1	–	–	–	5	–	2	–	2	–	6	–	–	2	21	–	18	41	2	21	–	11
–	3	–	–	–	7	–	4	–	10	–	3	–	13	–	2	–	19	–	4	–	104	1	26	131	–	97	1	26
–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	1	–	–	–	–	–	2	–	1	3	–	2	–	1
–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	2	–	–	2	–	2	–	–

CLASSIFICATION OF DEATHS

	Banes Division				Colombia Division				Costa Rica Division				Guatemala Division			
	Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.	
	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.
Gangrene of the lung	–	–	–	1	–	1	–	–	–	–	–	–	–	–	–	–
Asthma	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1
Other diseases of the respiratory system (tuberculosis excepted):																
Others	–	–	–	–	–	1	–	–	–	1	–	–	–	–	–	–
DISEASES OF THE DIGESTIVE SYSTEM:																
Diseases of the pharynx and tonsils (including adenoids):																
Others	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–
Ulcer of the stomach and duodenum:																
Ulcer of the duodenum	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–
Diarrhea and enteritis (under 2 years of age)	–	–	–	3	–	–	–	2	–	–	–	–	–	–	–	–
Diarrhea and enteritis (2 years and over)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Appendicitis and typhlitis	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–
Hernia, intestinal obstruction:																
Hernia	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Intestinal obstruction	–	–	–	1	–	1	–	–	–	1	–	–	–	–	–	–
Other diseases of the intestines:																
Other diseases of the intestines	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–
Cirrhosis of the liver:																
Not returned as alcoholic	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–
Biliary calculi	–	–	–	–	–	–	–	–	–	–	–	1	–	–	1	–
Other diseases of the liver:																
Other diseases of the liver	–	–	–	–	–	–	–	1	–	1	–	–	–	–	–	–
Peritonitis of unstated cause	–	–	–	–	–	2	–	2	–	1	–	1	–	–	–	–
Other diseases of the digestive system (cancer and tuberculosis excepted)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
NON-VENEREAL DISEASES OF THE GENITO-URINARY SYSTEM AND ITS ADNEXA:																
Acute nephritis (including unspecified under ten years of age)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Chronic nephritis (including unspecified over ten years of age)	–	5	–	–	–	1	–	1	–	3	–	–	–	1	–	–
Other diseases of the kidneys and their adnexa (diseases of the kidney in pregnancy not included)	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–
Diseases of the urethra, urinary abscess, etc:																
Stricture of the urethra	–	1	–	–	–	1	–	–	–	–	–	–	–	–	–	–
Diseases of the prostate (except tumors)	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–
Salpingitis or pelvic abscess	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Other diseases of the female genital organs	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–
THE PUERPERAL STATE:																
Accidents of pregnancy:																
Abortion	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Other accidents of pregnancy	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–
Puerperal hemorrhage	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–
Other accidents of childbirth:																
Other surgical operations and instrumental delivery	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Others	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–
Puerperal septicemia	–	–	–	–	–	–	–	1	–	–	–	1	–	–	–	–
Puerperal albuminuria or convulsions	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	1
DISEASES OF THE SKIN OR CELLULAR TISSUE:																
Gangrene	–	1	–	–	–	2	–	–	–	3	–	–	–	–	–	–
Boil, carbuncle, furuncle	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–
Phlegmon, acute abscess	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Other diseases of the skin and its adnexa:																
Other diseases of the skin and adnexa	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–

BY DISEASE—*Continued*

Jamaica Division				Panama Division				Preston Division				Tela Railroad				Truxillo Railroad				Semi-total					Deaths in Hospitals			
Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non. Emp.		Emp.		Non. Emp.		Emp.		Non. Emp.		Emp.		Non-Emp.			Emp.		Non-Emp.	
T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	Total	T.	O.	T.	O.
–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	2	3	–	1	–	2
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	1	–	–	–	1
–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	3	–	–	3	–	3	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	1	–	1	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	1	–	–	–	1
–	–	–	4	–	–	–	–	–	–	–	7	–	–	–	–	–	–	–	3	–	–	–	19	19	–	–	–	7
–	1	–	–	–	–	–	–	–	–	–	2	–	–	–	–	–	–	–	–	–	1	–	2	3	–	–	–	–
–	–	–	–	–	–	–	1	1	–	1	–	–	–	–	1	–	–	–	–	1	–	1	3	5	1	–	1	3
–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	1	–	–	1	–	1	–	–
–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	2	–	2	4	–	2	–	2
–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2	–	–	2	–	2	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	1	–	–	1	1	–	1	3	1	1	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	1	2	–	–	1	1
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	1	2	–	1	–	1
–	–	–	–	–	3	–	1	–	2	–	1	–	–	–	1	–	–	–	–	–	8	–	6	14	–	8	–	6
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	1	1	–	–	–	1
–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	1	–	–	–	–
–	3	–	–	1	3	–	1	–	4	–	–	–	–	–	–	1	2	–	–	2	22	–	2	26	2	18	–	2
–	–	–	–	–	2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2	–	1	3	–	2	–	1
–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2	1	–	3	–	2	1	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	1	–	–	1	–
–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	1	1	–	–	–	1
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	1	–	–	–	1
–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	2	2	–	–	–	2
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	2	2	–	–	–	2
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	1	–	–	–	1
–	–	–	–	–	–	–	–	–	–	–	2	–	–	–	–	–	–	–	–	–	–	–	2	2	–	–	–	2
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	2	2	–	–	–	2
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2	–	–	–	4	4	–	–	–	4
–	–	–	–	–	–	–	–	–	–	–	2	–	–	–	–	–	–	–	3	–	–	–	7	7	–	–	–	6
–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	6	–	1	7	–	6	–	1
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	1	–	–	–	1
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2	–	–	–	2	–	–	2	–	2	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	1	1	–	–	–	1

CLASSIFICATION OF DEATHS

	Banes Division				Colombia Division				Costa Rica Division				Guatemala Division			
	Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.	
	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.
DISEASES OF EARLY INFANCY:																
Congenital debility, icterus and sclerema:																
Marasmus	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–
Inanition	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1
Others	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Premature birth, or consequence of labor:																
Premature birth	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Injury at birth	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Other diseases peculiar to early infancy:																
Asphyxia neonatorum	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Others	–	–	–	1	–	–	–	1	–	–	–	–	–	–	–	–
OLD AGE																
Old age (senility)	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–
EXTERNAL CAUSES																
Suicide	–	–	–	3	–	–	–	–	–	–	–	–	–	–	–	–
Poisoning by venomous animals	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Other acute poisonings	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1
Burns and scalds	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Accidental drowning	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–
Injury by firearms	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Injury by cutting or piercing instruments	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Injury by falls	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–
Traumatism by machines	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Traumatism by other crushing (vehicles, railways, landslides, etc.)	–	–	–	–	–	–	–	1	–	2	–	–	–	–	–	–
Homicide by firearms	–	–	–	–	–	3	–	–	–	–	–	–	–	2	–	–
Homicide by cutting or piercing instruments	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–
Fractures (Cause not specified)	–	–	–	–	–	1	–	1	–	1	–	1	–	–	–	–
Other external violence:																
Criminal abortion	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Other external violence	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
ILL-DEFINED DISEASES:																
Sudden death	–	–	–	–	–	2	–	–	–	–	–	–	–	1	–	–
Infections of undetermined origin	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–
TOTAL	5	52	4	42	1	79	–	26	2	62	2	24	2	47	1	45

BY DISEASE—*Concluded*

Jamaica Division				Panama Division				Preston Division				Tela Railroad				Truxillo Railroad				Semi-total					Deaths in Hospitals			
Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.			Emp.		Non-Emp.	
T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	Total	T.	O.	T.	O.
–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	3	3	–	–	–	1
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	1	–	–	–	1
–	–	–	–	–	–	–	1	–	–	–	5	–	–	–	–	–	–	–	1	–	–	–	7	7	–	–	–	2
–	–	–	–	–	–	–	1	–	–	–	2	–	–	–	–	–	–	–	2	–	–	–	5	5	–	–	–	3
–	–	–	–	–	–	–	–	–	–	–	2	–	–	–	–	–	–	–	–	–	–	–	2	2	–	–	–	1
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2	–	–	–	–	–	–	–	2	2	–	–	–	2
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2	2	–	–	–	1
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	1	–	1	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	3	3	–	–	–	3
–	–	–	–	–	–	–	2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2	2	–	–	–	2
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	1	–	–	–	1
–	–	–	–	–	1	–	–	–	–	–	2	–	–	–	1	–	2	–	1	–	3	–	4	7	–	3	–	4
–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2	–	–	2	–	–	–	–
–	–	–	–	–	–	–	1	–	1	–	–	–	–	–	2	–	1	–	3	–	2	–	6	8	–	2	–	6
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	3	–	–	–	3	–	–	3	–	3	–	–
–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	1	–	1	2	1	–	4	1	1	1	–
–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	1	–	–	1	–	1	–	–
–	–	–	–	–	3	–	1	–	–	1	–	–	2	1	1	–	–	–	–	–	7	2	3	12	–	6	2	3
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2	–	–	–	–	–	5	–	2	7	–	4	–	2
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	1	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	2	–	3	5	–	2	–	3
–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	1	1	–	–	–	1
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	1	1	–	–	–	1
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	3	–	–	3	–	1	–	–
–	–	–	–	–	1	–	1	–	1	–	–	–	–	–	1	–	–	–	–	–	3	–	2	5	–	3	–	2
–	19	1	11	2	55	–	42	1	71	2	65	–	42	2	34	3	61	3	34	16	488	15	323	842	15	448	15	259

RECORD OF

	Banes Division				Colombia Division				Costa Rica Division				Guatemala Division			
	Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.	
	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.
ENDEMIC OR INFECTIOUS DISEASES:																
Malarial fever or cachexia:																
(a) Estivo autumnal	–	1	–	–	–	1	–	–	–	–	–	–	–	–	–	–
Dysentery:																
(a) Amebic	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–
Leprosy	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–
Epidemic cerebro-spinal meningitis	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Tuberculosis of the respiratory system:																
(a) Acute pulmonary tuberculosis	–	2	–	–	–	43	–	–	–	–	–	–	1	–	–	–
Tuberculosis of the intestines or peritoneum	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Tuberculosis of the joints	–	–	–	–	–	2	–	–	–	–	–	–	–	–	–	–
Syphilis (includes syphilitic infection of any organ, tissue or structure of the body):																
(c) Tertiary	–	–	–	–	–	2	–	–	–	–	–	–	–	–	–	–
GENERAL DISEASES NOT INCLUDED ABOVE:																
Cancer or other malignant tumors of the buccal cavity:																
(c) Cancer of the mouth	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
(d) Cancer of the jaw	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–
(e) Others	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–
Cancer or other malignant tumors of the stomach and liver:																
(c) Cancer of the stomach	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–
Beri-beri	–	–	–	–	–	3	–	–	–	–	–	–	–	–	–	–
Anemia, Chlorosis:																
(b) Other anemias and chlorosis	–	–	–	–	–	3	–	–	–	–	–	–	–	–	–	–
DISEASES OF THE NERVOUS SYSTEM AND ORGANS OF SPECIAL SENSE																
Progressive locomotor ataxia (tabes dorsalis)	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Paralysis (without specified cause):																
(a) Hemiplegia	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–
Other forms of mental alienation	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Other diseases of the nervous system	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Diseases of the organs of vision and adnexa (except gonococcal infection):																
(a) Diseases of the eye (except tumor)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
(e) Other diseases of the eye or its adnexa	–	–	–	–	–	3	–	–	–	–	–	–	–	–	–	–
DISEASES OF THE CIRCULATORY SYSTEM:																
Other diseases of the heart:																
(b) Chronic myocarditis	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–
(c) Other chronic diseases of the heart	–	–	–	–	–	2	–	–	–	–	–	–	–	–	–	–
Aneurism	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
DISEASES OF THE RESPIRATORY SYSTEM:																
Bronchitis:																
(b) Chronic	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–
Pneumonia:																
(a) Lobar	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–
Pleurisy:																
(a) Pleurisy	–	–	–	–	–	2	–	–	–	–	–	–	–	–	–	–
Asthma	–	–	–	–	–	3	–	–	–	–	–	–	–	–	–	–
Other diseases of the respiratory system (tuberculosis excepted):																
(a) Chronic interstitial pneumonia (including occupational diseases of the lung)	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–

REPATRIATIONS

Jamaica Division				Panama Division				Preston Division				Tela Railroad				Truxillo Railroad				Semi-total				
Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.		
T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	Total
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2	–	–	2
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	1
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	1
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	1
–	–	–	–	–	1	–	–	–	6	–	–	–	–	–	–	–	3	–	–	1	55	–	–	56
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	1
–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	3	–	–	3
–	–	–	–	–	–	–	–	–	3	–	–	–	–	–	–	–	–	–	–	–	5	–	–	5
–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	1
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	1
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	1
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	1
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	3	–	–	3
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	3	–	–	3
–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	2	–	–	2
–	–	–	–	–	–	–	–	–	2	–	–	–	–	–	–	–	–	–	–	–	3	–	–	3
–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	1	–	–	1
–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	1	–	–	–	1
–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	1	–	–	1
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	3	–	–	3
–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	2	–	–	2
–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	2	–	1	3
–		–	–	–	2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2	–	–	2
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	1
–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	2	–	–	2
–	–	–	–	–	–	–	–	–	2	–	–	–	–	–	–	–	–	–	–	–	4	–	–	4
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	3	–	–	3
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	1

RECORD OF

	Banes Division				Colombia Division				Costa Rica Divison				Guatemala Division			
	Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.	
	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.
DISEASES OF THE DIGESTIVE SYSTEM:																
Diseases of the mouth and adnexa:																
(b) Other diseases of the buccal cavity and adnexa	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–
Cirrhosis of the liver:																
(b) Not returned as alcoholic	–	1	–	–	–	4	–	–	–	–	–	–	–	–	–	–
NON-VENEREAL DISEASES OF THE GENITO-URINARY SYSTEM AND ITS ADNEXA:																
Non-venereal diseases of the male genital organs	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
DISEASES OF THE SKIN OR CELLULAR TISSUE:																
Other diseases of the skin and its adnexa:																
(i) Elephantiasis	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–
(m) Ulcer of the skin	–	–	–	–	–	4	–	–	–	–	–	–	–	–	–	–
DISEASES OF THE BONES AND ORGANS OF LOCOMOTION:																
Diseases of the joints (tuberculosis and rheumatism excepted)	–	–	–	–	–	6	–	–	–	–	–	–	–	–	–	–
EXTERNAL CAUSES:																
Injury by cutting or piercing instruments	–	–	–	–	–	3	–	–	–	–	–	–	–	–	–	–
Traumatism by other crushing (vehicles, railways, landslides, etc.)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Other external violence:																
(e) Other external violence	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
TOTAL	–	8	–	–	–	91	–	–	–	1	–	–	1	–	–	–

REPATRIATIONS—*Concluded*

Jamaica Division				Panama Division				Preston Division				Tela Railroad				Truxillo Railroad				Semi-total				
Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.		
T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	Total
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	1
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	5	–	–	5
–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	1	–	–	1
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	1
–	–	–	–	–	–	–	–	–	5	–	–	–	–	–	–	–	–	–	–	–	9	–	–	9
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	6	–	–	6
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	3	–	–	3
–	–	–	–	–	–	–	–	–	2	–	–	–	–	–	–	–	–	–	–	–	2	–	–	2
–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	1	–	–	1
–	–	–	–	–	4	–	1	–	28	–	–	1	–	–	–	–	3	–	–	2	135	–	1	138

CLASSIFICATION OF DISEASES

	Banes Division				Colombia Division				Costa Rica Division				Guatemala Division				Jamaica Division			
	Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.	
	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.
Endemic or Infectious Diseases:																				
Typhoid fever (abdominal typhoid and paratyphoid):																				
Typhoid fever	1	6	1	13	4	34	–	13	–	4	2	3	–	–	1	1	–	–	–	–
Paratyphoid fever	–	–	–	1	1	11	–	3	–	4	1	14	–	1	–	–	–	–	–	–
Typhus fever (exanthematous)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Relapsing fever	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Melito-coccosis (Malta fever)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Malarial fever or cachexia:																				
Estivo-autumnal	62	1,916	1	108	6	257	1	6	11	431	9	228	17	761	17	423	1	–	1	–
Tertian	7	88	1	7	6	129	–	5	10	462	11	119	11	340	10	166	8	6	1	–
Quartan	3	42	–	3	–	35	–	1	–	2	–	–	–	8	0	4	–	–	–	–
Mixed	2	5	–	–	–	–	–	–	–	–	–	–	2	52	3	28	–	–	–	–
Clinical	10	97	1	25	3	72	–	1	8	747	4	161	32	254	26	130	–	2	1	1
Cachexia	–	15	–	6	–	1	–	–	–	5	–	2	1	6	–	4	–	–	–	–
Hemoglobinuric fever	4	45	1	25	–	2	–	–	2	21	–	9	–	8	–	14	–	–	–	1
Smallpox	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Measles	–	46	–	6	2	59	1	2	–	5	–	–	–	3	–	1	–	–	–	–
Scarlet fever	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–
Whooping cough	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Diphtheria	–	–	–	1	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Influenza: (Complications):																				
Pneumonia	–	2	–	–	–	1	–	–	–	–	–	–	–	1	–	–	–	–	–	–
Bronchitis	6	33	–	3	1	32	–	–	2	–	–	–	2	39	1	10	–	–	1	–
Heart disease	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Nephritis	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Meningitis	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Gastro-intestinal	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–
Puerperal	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Others	–	–	–	–	2	94	–	2	6	31	–	4	–	–	–	–	–	–	–	–
Miliary fever	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Mumps	–	–	–	–	–	1	–	–	–	4	–	1	–	–	–	–	–	–	–	–
Asiatic cholera	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Cholera nostras (choleriform enteritis)	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–
Dysentery:																				
Amebic	–	14	1	1	4	284	1	13	–	29	–	6	1	12	–	12	–	–	–	–
Bacillary	–	1	–	–	–	4	–	–	–	2	–	–	–	9	1	5	–	–	–	–
Unspecified or due to other causes	–	5	–	–	1	20	–	2	–	2	–	2	–	9	–	4	–	–	–	–
Plague:																				
Bubonic	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Pneumonic	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Septicemic	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Unspecified	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Yellow fever	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Ictero-hemorrhagica spirochetosis	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Leprosy	–	–	–	–	–	2	–	–	–	–	–	1	–	–	–	1	–	–	–	–
Erysipelas	–	1	–	–	–	4	–	–	2	7	–	1	–	6	–	2	–	–	–	–
Acute poliomyelitis	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Encephalitis lethargica	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Epidemic cerebro-spinal meningitis	–	4	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Other epidemic diseases:																				
Alastrim, or Kaffir milk-pox	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	
Varicella	–	1	–	–	–	17	–	–	–	–	1	–	–	–	–	–	–	–	–	
Rubella	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	
Dengue	–	–	–	–	2	4	–	1	–	–	–	–	–	–	–	–	–	–	–	
Yaws	–	1	–	–	–	4	–	–	–	–	–	–	–	–	–	–	–	–	–	
Others	–	–	–	–	–	3	–	–	–	–	–	–	–	–	–	–	–	–	–	
Purulent or septicemic infection	–	–	–	–	1	8	–	1	1	9	1	1	–	6	–	6	–	–	1	
Glanders and farcy	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	
Malignant pustule (anthrax)	–	–	–	–	–	–	–	–	–	2	–	–	–	–	–	–	–	–	–	
Rabies	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	
Tetanus	–	–	–	–	–	–	–	2	–	2	–	1	–	–	–	–	–	–	–	
Mycoses	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	

TREATED IN HOSPITALS

Panama Division				Preston Division				Tela Railroad				Truxillo Railroad				Semi-Total					Deaths in Hospitals			
Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.		Total	Emp.		Non-Emp.	
T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.		T.	O.	T.	O.
–	1	–	3	–	5	–	8	1	19	1	3	–	–	–	–	6	69	5	44	124	–	11	3	10
1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2	16	1	18	37	–	–	–	1
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
1	42	–	19	6	735	–	49	12	479	10	124	21	554	2	45	137	5,175	41	1,002	6,355	–	42	–	17
8	324	5	117	2	34	1	4	2	78	1	15	3	85	1	11	57	1,546	31	444	2,078	–	1	–	5
–	–	–	–	–	34	–	–	–	13	–	2	1	23	–	4	4	157	–	14	175	–	1	–	–
1	12	–	6	–	9	–	1	2	17	1	2	–	17	–	1	7	112	4	38	161	–	1	–	2
10	83	–	30	2	112	1	11	3	61	1	12	7	166	1	21	75	1,594	35	392	2,096	–	2	–	1
–	26	–	6	–	–	–	–	–	18	–	3	–	35	–	3	1	106	–	24	131	–	3	–	1
–	3	–	1	–	7	–	5	–	7	–	–	–	11	–	1	6	104	1	56	167	3	17	1	11
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	49	–	2	–	6	–	2	–	8	–	4	2	176	1	17	196	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	1	–	–	–	–
–	–	–	1	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	2	2	–	–	–	1
–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	1	–	2	3	–	–	–	–
–	2	–	3	–	–	–	–	1	–	–	–	1	4	–	–	2	10	–	3	15	–	–	–	–
1	2	–	–	–	–	–	–	5	139	5	7	12	40	1	1	29	285	8	21	343	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	1	1	–	–	2	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	1	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
15	17	3	1	1	–	–	–	1	10	3	–	3	6	–	–	28	158	6	7	199	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	5	–	–	–	4	–	2	–	2	–	–	–	16	–	3	19	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	1	–	–	–	–
1	17	–	5	1	10	–	2	6	54	7	28	1	21	–	5	14	441	9	72	536	1	12	–	4
–	–	–	–	–	1	–	1	–	4	–	2	–	1	–	–	–	22	1	8	31	–	5	–	3
–	17	–	1	–	4	–	–	–	1	1	2	2	7	–	2	3	65	1	13	82	–	2	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	2	–	–	–	–	–	–	–	4	–	2	6	–	–	–	–
–	4	–	2	–	–	–	–	1	2	–	3	–	1	–	1	3	25	–	9	37	–	1	–	1
–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	1	1	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	4	–	–	4	–	2	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	1	–	–	–	1	–	–	–	8	–	–	–	1	–	1	–	29	1	1	31	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2	4	–	1	7	–	–	–	–
–	3	–	–	–	30	–	–	–	–	–	–	–	–	–	–	–	38	–	–	38	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	3	–	–	3	–	–	–	–
–	8	–	–	1	5	–	1	–	1	–	2	–	2	–	2	3	39	2	13	57	–	24	–	11
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	2	–	1	3	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	2	–	–	–	3	–	2	–	2	–	1	–	1	–	5	–	11	16	–	3	–	5
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–

CLASSIFICATION OF DISEASES

	Banes Division				Colombia Division				Costa Rica Division				Guatemala Division				Jamaica Division			
	Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.	
	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.
Endemic or Infectious Diseases —*Continued*																				
Tuberculosis of the respiratory system:																				
Acute pulmonary tuberculosis	2	18	–	2	–	59	–	3	1	18	–	26	1	25	–	16	–	–	–	1
Other forms of tuberculosis of respiratory organs	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Tuberculosis of the meninges or of the central nervous system	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Tuberculosis of the intestines or peritoneum	–	2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Tuberculosis of the vertebral column	–	–	–	–	–	–	–		–	1	–	–	–	–	–	–	–	–	–	–
Tuberculosis of the joints	–	–	–	–	–	2	–	–	–	–	–	–	–	1	–	–	–	–	–	–
Tuberculosis of other organs and structures:																				
Tuberculosis of the skin or subcutaneous cellular tissue	2	1	–	–	–	–	–	–	–	2	–	–	–	–	–	–	–	–	–	–
Tuberculosis of the bones (except vertebral column)	–	–	–	1	–	–	–	1	–	1	–	1	–	1	–	–	–	–	–	–
Tuberculosis of the lymphatic system (except the mesenteric and retroperitoneal glands)	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–
Tuberculosis of the genito-urinary system	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–
Tuberculosis of other organs	–	–	–	–	–	–	–	–	–	1	–	1	–	–	–	–	–	–	–	–
Disseminated tuberculosis:																				
Acute (including miliary tuberculosis of the lungs, except that specified as chronic or pulmonary)	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–
Chronic	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Syphilis (includes syphilitic infection of any organ, tissue or structure of the body):																				
Primary	–	6	–	–	–	2	1	–	–	26	3	4	–	26	–	7	–	–	–	–
Secondary	–	55	–	–	–	1	–	–	1	67	–	12	–	31	–	6	–	–	–	–
Tertiary	–	7	–	–	1	181	–	3	3	82	–	23	–	16	–	3	–	–	–	–
Hereditary	–	–	–	–	–	–	–	–	–	1	–	–	–	2	–	1	–	–	–	–
Period not specified	–	–	–	–	–	–	–	–	–	1	–	–	–	7	–	2	–	–	–	–
Soft chancre	–	5	–	–	–	48	–	–	1	54	2	22	–	13	–	2	–	–	–	–
Gonococcal infection except that of the eye or adnexa	1	22	–	5	–	104	1	3	2	167	9	40	1	38	3	12	–	–	–	–
Gonococcal ophthalmia	–	–	–	–	–	1	–	–	–	–	1	–	–	–	–	–	–	–	–	–
General Diseases Not Included Above:																				
Cancer or other malignant tumors of the buccal cavity:																				
Cancer of the lip	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Cancer of the tongue	–	–	–	–	1	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–
Cancer of the mouth	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Cancer of the jaw	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Others	–	1	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Cancer or other malignant tumors of the stomach and liver:																				
Cancer of the pharynx	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Cancer of the esophagus	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Cancer of the stomach	–	–	–	–	–	1	–	–	–	–	–	1	–	–	–	1	–	–	–	–
Cancer of the liver and gall bladder	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Cancer or other malignant tumors of the peritoneum, intestines and rectum:																				
Cancer of the mesentery and peritoneum	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Cancer of the intestines (except rectum)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Cancer of the rectum and anus	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Others	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Cancer or other malignant tumors of the female genital organs:																				
Cancer of the ovary and Fallopian tubes	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Cancer of the uterus	–	–	–	–	–	1	–	–	–	–	–	1	–	1	–	1	–	–	–	–
Cancer of the vagina and vulva	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–

TREATED IN HOSPITALS—*Continued*

Panama Division				Preston Division				Tela Railroad				Truxillo Railroad				Semi-total					Deaths in Hospitals			
Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.			Emp		Non-Emp.	
T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	Total	T.	O.	T.	O.
–	5	–	5	1	28	–	1	–	34	1	11	–	26	–	6	5	213	1	71	290	1	34	–	16
–	1	–	–	–	–	–	–	–	2	2	3	–	4	–	1	–	7	2	5	14	–	1	–	–
–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	1	–	1	2	–	1	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2	–	–	2	–	–	–	–
–	–	–	1	–	–	–	1	–	–	–	–	–	–	–	–	–	1	–	2	3	–	–	–	–
–	–	–	–	–	1	–	1	–	3	–	2	–	–	–	–	–	7	–	3	10	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2	3	–	–	5	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	2	–	4	6	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	1	–	1	2	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	1	–	–	–	–
–	1	–	–	–	1	–	–	–	–	–	1	–	–	–	–	–	3	–	2	5	–	2	–	–
1	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	2	–	–	3	1	2	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	2	–	–	–	2	–	–	2	–	–	–	–
–	11	–	–	–	1	–	–	–	7	–	–	–	4	–	–	–	83	4	11	98	–	–	–	–
–	5	–	–	–	13	–	–	–	10	–	2	–	3	–	1	1	185	–	21	207	–	2	–	–
–	101	–	40	1	72	–	6	1	48	2	24	1	45	–	6	7	552	2	105	666	–	3	–	3
–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	4	–	1	5	–	–	–	1
–	26	–	21	–	1	–	–	–	1	–	1	–	–	–	–	–	36	–	24	60	–	1	–	–
–	5	1	–	–	14	1	1	–	66	–	3	–	2	1	–	1	207	5	28	241	–	–	–	–
–	74	–	16	4	22	1	3	1	46	4	8	3	31	–	15	12	504	18	102	636	–	–	–	–
–	1	–	1	–	1	–	–	–	–	–	1	–	–	–	1	–	3	1	3	7	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	1	2	–	–	–	–
–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	1	–	–	–	–
–	–	–	–	–	–	–	–	–	1	–	1	–	–	–	–	–	2	–	1	3	–	1	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2	–	–	2	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	1	–	–	1	–	1	–	–
–	1	–	–	–	–	–	1	–	–	–	–	–	–	1	–	–	2	1	3	6	–	1	1	1
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	1	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	1	1	–	–	–	1
–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	1	–	1	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	1	–	–	–	2	–	–	–	1	–	2	–	6	8	–	–	–	1
–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	1	–	–	–	–

CLASSIFICATION OF DISEASES

	Banes Division				Colombia Division				Costa Rica Division				Guatemala Division				Jamaica Division		
	Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.
	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.
General Diseases Not Included Above: —*Continued*																			
Others	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Cancer or other malignant tumors of the breast	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Cancer or other malignant tumors of the skin	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Cancer or other malignant tumors of other or unspecified organs:																			
Cancer of the larynx	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Cancer of the lungs and pleura	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Cancer of the pancreas	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Cancer of the kidneys and suprarenals	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Cancer of the prostate	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Cancer of the bladder	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Cancer of the brain	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Cancer of the bones (except jaw)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Cancer of the testes	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–
Others	–	–	–	–	–	–	–	–	–	–	–	2	–	–	–	–	–	–	–
Benign tumors and tumors not returned as malignant (except benign or non-specified tumors of the ovary and uterus):																			
Tumor of brain	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Tumor of thorax	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Tumor of abdomen	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–
Tumor of bladder	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Tumor of prostate	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Tumors in other locations	–	4	1	4	–	3	–	2	–	3	–	4	–	–	–	–	–	–	–
Acute febrile articular rheumatism	–	20	–	1	–	18	–	1	3	53	–	12	1	–	–	–	–	–	1
Chronic rheumatism or gout:																			
Chronic rheumatism	–	7	–	–	–	7	–	–	1	15	–	1	2	5	1	8	–	–	–
Chronic gout	–	3	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Scurvy	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Pellagra	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–
Beri-beri	–	–	–	–	–	14	–	1	–	–	–	–	–	–	–	–	–	–	–
Rickets	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Diabetes	–	–	–	1	–	–	–	1	–	1	–	–	–	–	–	–	–	–	–
Anemia, Chlorosis:																			
Pernicious anemia	–	3	1	–	–	1	–	–	–	–	–	1	–	1	–	2	–	–	–
Other anemias and chlorosis	–	10	–	5	–	28	–	1	–	3	–	1	–	–	–	1	–	–	–
Diseases of the pituitary gland	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Diseases of the thyroid gland:																			
Exophthalmic goitre	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Other diseases of the thyroid gland	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–
Diseases of the parathyroid glands	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Diseases of the thymus	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Addison's disease (disease of the adrenals)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Disease of the spleen	–	2	–	–	–	16	–	–	–	6	–	3	–	–	–	–	–	–	–
Leukemia and Hodgkin's disease:																			
Leukemia	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Hodgkin's disease	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Alcoholism (acute or chronic)	–	2	–	–	–	–	1	–	–	2	1	6	3	4	4	4	–	–	–
Chronic poisoning by mineral substances	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Chronic poisoning by organic substances	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Other general diseases:																			
Acidosis	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–
Amyloid degenerations	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Autointoxications	–	–	–	–	3	5	–	3	–	–	–	–	–	–	–	–	–	–	–
Hemophilia	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–
Purpura hemorrhagica	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Others	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–

TREATED IN HOSPITALS—*Continued*

Panama Division				Preston Division				Tela Railroad				Truxillo Railroad				Semi-total					Deaths in Hospitals			
Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.			Emp.		Non-Emp.	
T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	Total	T.	O.	T.	O.
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	1	–	–	–	–	–	1	–	–	–	–	–	–	–	1	–	1	2	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	1	1	–	–	–	–
–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	1	–	–	1	–	1	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	1	–	–	–	–
–	1	–	–	–	–	–	1	–	1	–	7	–	–	–	–	–	2	–	10	12	–	–	–	–
–	–	–	–	–	–	–	1	–	–	–	1	–	–	–	–	–	–	–	2	2	–	–	–	1
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	1	–	1	–	1	–	–	–	–	–	–	–	–	–	1	–	3	4	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	10	–	4	–	3	–	3	–	2	1	–	1	1	–	–	1	26	2	17	46	–	2	–	1
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	4	91	1	14	110	–	–	–	–
2	38	–	6	–	9	–	1	–	3	–	1	–	2	–	1	5	86	1	18	110	–	–	–	–
–	–	–	–	–	–	–	–	1	–	1	–	–	–	–	–	1	3	1	1	6	–	–	–	–
–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	1	–	–	1	–	–	–	–
–	1	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	2	3	–	–	–	1
–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	15	–	1	16	–	1	–	–
–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	1	1	–	–	–	–
–	1	–	–	–	1	–	–	–	–	–	1	–	–	–	–	–	3	–	3	6	–	–	–	2
–	–	–	–	–	3	1	1	–	2	–	–	–	–	–	–	–	10	2	4	16	–	1	–	1
–	3	–	4	–	1	–	–	–	16	3	3	–	1	1	1	–	62	4	16	82	–	2	–	1
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	1	–	2	–	–	–	–	–	–	–	–	–	1	–	2	3	–	–	–	–
–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	1	–	2	–	1	3	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	1	–	–	–	–	–	1	–	–	–	25	–	4	29	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	1	–	–	–	1
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
2	–	–	–	–	1	–	1	1	–	1	1	1	–	3	–	7	9	10	12	38	1	–	–	1
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	1	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	1	–	–	–	3	1	3	–	–	–	–	–	–	–	–	3	9	1	6	19	–	1	–	–
–	3	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	4	–	1	5	–	–	–	–
–	1	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	2	–	–	2	–	1	–	–
–	–	–	–	–	–	–	–	–	1	–	1	–	–	–	–	–	2	–	1	3	–	–	–	–

CLASSIFICATION OF DISEASES

	Banes Division				Colombia Division				Costa Rica Division				Guatemala Division				Jamaica Division			
	Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.	
	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.
Diseases of the Nervous System and Organs of Special Sense:																				
Encephalitis	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–
Meningitis:																				
Simple	–	–	–	–	–	3	–	2	–	–	–	–	–	1	–	–	–	–	–	–
Non-epidemic cerebro-spinal meningitis	–	–	–	1	–	–	–	1	–	–	–	–	–	1	–	–	–	–	–	–
Progressive locomotor ataxia (*tabes dorsalis*)	–	1	–	–	–	–	–	–	–	–	–	1	–	–	–	1	–	–	–	–
Other diseases of the spinal cord:																				
Bulbar paralysis (Duchenne's disease)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Paralysis agitans (Parkinson's disease)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Acute ascending spinal paralysis (Landry's disease)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Myelitis	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Others	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–
Cerebral hemorrhage, apoplexy:																				
Cerebral hemorrhage	–	–	–	–	–	3	–	–	–	2	–	–	–	–	1	–	–	–	–	–
Cerebral thrombosis and embolism	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Paralysis (without specified cause):																				
Hemiplegia	–	–	–	–	–	–	–	–	1	4	–	2	–	–	–	–	–	–	–	–
Other forms of paralysis	–	1	–	–	–	2	–	–	–	1	–	–	–	1	–	–	–	–	–	–
General paralysis (of the insane)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Other forms of mental alienation	–	2	–	2	–	–	–	–	–	5	–	2	–	–	–	–	–	–	–	–
Epilepsy	–	2	–	1	–	2	–	–	–	–	–	1	–	1	–	–	–	–	–	–
Convulsions (non-puerperal, 5 years and over)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Infantile convulsions (under 5 years of age)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Chorea:																				
Chorea	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–
Hysteria and neuralgia	–	5	–	–	–	11	–	–	–	8	2	1	–	1	–	–	–	–	–	–
Neuritis	1	2	–	–	–	23	1	–	1	1	–	–	–	–	–	–	–	–	1	–
Softening of the brain	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Other diseases of the nervous system	–	–	–	–	–	23	–	1	3	4	1	–	1	5	3	1	–	–	–	–
Diseases of the organs of vision and adnexa (except gonococcal infection):																				
Diseases of the eye (except tumor)	–	3	–	1	–	3	–	–	–	1	–	–	–	–	–	–	–	–	–	–
Follicular conjunctivitis	–	1	–	–	–	23	–	–	–	2	–	–	–	38	–	7	–	–	–	–
Trachoma	–	–	–	2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Tumors of the eye	–	1	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Other diseases of the eye or its adnexa	1	16	–	–	–	39	2	–	1	13	–	–	3	5	1	–	–	–	–	–
Diseases of the organs of hearing and the mastoid process:																				
Diseases of the ear	1	5	–	–	1	19	–	1	1	9	1	5	1	9	–	4	–	–	–	–
Diseases of the mastoid process	–	1	–	1	–	–	–	–	–	–	1	–	–	2	–	–	–	–	–	–
Diseases of the Circulatory System:																				
Pericarditis	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Acute endocarditis and myocarditis:																				
Acute endocarditis	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–
Acute myocarditis	–	1	–	–	–	–	–	–	–	2	–	–	–	1	–	–	–	–	–	–
Angina pectoris	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–
Other diseases of the heart:																				
Chronic endocarditis	–	–	–	–	–	1	–	–	–	2	–	2	1	–	–	–	–	–	–	–
Chronic myocarditis	–	–	–	1	–	3	–	–	–	3	1	3	–	1	1	1	–	–	2	–
Other chronic diseases of the heart	–	6	–	1	–	3	–	2	1	9	–	6	1	10	1	5	–	–	–	–
Aneurism	–	–	–	–	–	–	–	–	–	2	–	–	–	–	–	–	–	–	–	–
Atheroma and other diseases of the arteries	–	–	–	–	–	4	–	–	–	5	–	4	–	–	–	2	–	–	2	–
Embolism and thrombosis (except cerebral)	–	–	–	–	–	1	–	–	–	2	–	–	–	1	–	–	–	–	–	–
Diseases of the veins (varices, hemorrhoids, phlebitis, etc.)	1	1	1	–	1	23	–	4	1	12	–	5	1	4	4	3	1	1	–	–
Diseases of the lymphatic system (lymphangitis, etc.)	2	2	–	–	1	92	3	3	2	81	2	16	8	32	3	7	–	–	–	–
Hemorrhage without determined cause; other diseases of the circulatory system	–	3	–	–	–	–	–	–	–	1	–	–	–	5	1	4	–	–	–	–

TREATED IN HOSPITALS—*Continued*

Panama Division				Preston Division				Tela Railroad				Truxillo Railroad				Semi-Total					Deaths in Hospitals			
Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.			Emp.		Non-Emp.	
T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	Total	T.	O.	T.	O.
–	–	–	–	–	–	–	–	–	1	–	–	–	1	–	–	–	3	–	–	3	–	2	–	–
–	1	–	–	–	2	–	–	–	1	–	2	–	1	–	–	–	9	–	4	13	–	7	–	1
–	1	–	3	–	1	–	–	–	2	–	4	–	2	–	2	–	7	–	11	18	–	6	–	10
–	–	–	–	–	3	–	–	–	–	–	–	–	–	–	–	–	4	–	2	6	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	2	–	–	–	–	–	2	–	–	–	–	–	–	–	–	–	2	–	2	4	–	2	–	1
–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2	2	–	–	–	–
–	4	–	1	–	1	–	–	–	1	–	–	–	–	–	–	–	11	1	1	13	–	9	–	1
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	3	–	–	–	–	–	1	–	–	–	–	1	7	–	3	11	–	–	–	–
2	6	–	1	–	–	–	1	–	1	–	–	–	–	–	–	2	12	–	2	16	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	2	–	2	–	2	–	7	–	–	–	1	–	–	–	17	–	8	25	–	2	–	–
–	–	–	3	–	1	–	1	–	–	–	1	–	–	–	1	–	6	–	8	14	–	–	–	–
–	–	–	–	–	–	–	–	–	1	–	–	–	2	–	–	–	3	–	–	3	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	1	–	–	–	2	2	–	–	–	1
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	1	–	–	–	–
1	7	–	1	–	1	–	1	1	8	2	4	–	2	–	–	2	43	4	7	56	–	–	–	–
3	9	–	3	1	5	–	1	1	4	–	1	–	6	–	–	7	50	2	5	64	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	1	–	–	–	–
6	11	1	9	1	13	2	8	1	4	2	7	1	1	1	2	13	61	10	28	112	–	–	1	–
–	1	–	–	1	10	–	–	2	72	–	2	2	11	–	–	5	101	–	3	109	–	–	–	–
–	6	–	2	–	14	–	–	–	4	1	1	–	–	–	–	–	88	1	10	99	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2	2	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	2	–	1	–	3	–	2	5	–	–	–	–
–	20	–	5	–	2	–	–	2	1	–	6	–	3	–	–	7	99	3	11	120	–	–	–	–
	17	–	3	–	6	–	2	3	26	1	2	5	18	–	5	12	109	2	22	145	–	–	–	–
–	–	–	–	–	2	–	–	–	1	–	1	–	3	–	–	–	9	1	2	12	–	1	–	–
–	2	–	–	–	–	–	–	–	–	–	–	–	1	–	2	–	3	–	2	5	–	2	–	1
–	–	–	–	–	5	–	–	–	1	–	–	–	–	–	–	–	7	–	–	7	–	3	–	–
–	–	–	–	–	–	–	–	–	2	–	2	–	2	–	–	–	8	–	2	10	–	2	–	–
–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	1	–	1	–	2	3	–	–	–	1
–	–	–	2	–	–	–	–	–	–	–	–	–	2	–	–	1	5	–	4	10	–	–	–	1
2	5	–	2	2	2	–	–	–	1	–	6	–	3	2	1	4	18	6	14	42	–	6	1	2
–	13	–	6	–	14	–	3	–	2	–	1	–	4	1	1	2	61	2	25	90	1	14	–	4
–	2	–	–	–	–	–	–	–	–	–	2	–	3	–	–	–	7	–	2	9	–	1	–	–
–	1	–	1	–	1	1	–	–	–	–	1	–	–	–	–	–	11	3	8	22	–	1	–	–
–	1	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	5	–	1	6	–	2	–	1
2	15	–	2	2	–	–	–	3	5	–	1	4	1	–	–	16	62	5	15	98	–	–	–	–
–	29	1	9	4	15	–	1	1	31	1	4	3	25	1	–	21	307	11	40	379	–	–	–	–
–	3	–	1	–	–	–	–	–	–	–	–	–	2	–	–	–	14	1	5	20	–	2	–	1

CLASSIFICATION OF DISEASES

	Banes Division				Colombia Division				Costa Rica Division				Guatemala Division				Jamaica Division			
	Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp..		Emp.		Non-Emp.		Emp.		Non-Emp.	
	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O	T.	O.	T.	O.
Diseases of the Respiratory System:																				
Diseases of the nasal fossae and their adnexa:																				
Diseases of the nasal fossae	–	–	–	–	–	3	–	1	–	–	–	1	–	–	1	–	–	–	–	–
Others	–	1	–	–	–	–	–	–	–	2	–	2	–	1	–	–	–	–	–	–
Diseases of the larynx (except tuberculosis and cancer)	–	1	–	–	–	3	–	–	–	1	–	1	–	5	–	6	–	–	–	–
Bronchitis:																				
Acute	2	22	1	13	1	107	–	1	1	24	–	3	3	29	4	20	–	–	–	–
Chronic	–	4	–	1	–	13	–	1	–	4	1	1	–	–	–	3	–	–	–	–
Not otherwise defined, under 5 years of age	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–
Not otherwise defined, 5 years and over	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Broncho pneumonia (including capillary bronchitis):																				
Broncho pneumonia	3	26	–	18	–	34	–	3	–	8	–	2	–	8	–	7	–	–	–	–
Capillary bronchitis	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Pneumonia:																				
Lobar	1	80	1	4	1	78	–	3	–	1	–	3	–	44	1	22	–	–	1	–
Not otherwise specified	–	3	–	–	–	2	–	–	–	2	–	–	–	–	–	–	–	–	–	–
Pleurisy:																				
Pleurisy	–	11	–	–	2	27	–	1	–	5	–	4	–	3	–	–	–	–	–	–
Empyema of thoracic cavity	–	1	–	1	–	2	–	–	–	–	–	–	–	1	–	–	–	–	–	–
Congestion or parenchymatous hemorrhage of the lung	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Gangrene of the lung	–	–	–	1	–	1	–	–	–	–	–	–	–	–	–	–	1	–	–	–
Asthma	–	1	–	–	2	22	1	–	–	22	–	5	–	1	1	4	–	–	–	–
Emphysema of the lung	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–
Other diseases of the respiratory system (tuberculosis excepted):																				
Chronic interstitial pneumonia (including occupational diseases of the lung)	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–
Diseases of the mediastinum	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Others	–	5	–	–	–	3	–	–	1	2	–	1	–	–	–	–	–	–	–	–
Diseases of the Digestive System:																				
Diseases of the mouth and adnexa:																				
Diseases of the teeth and gums	–	51	–	–	1	17	1	–	–	22	–	6	2	9	2	5	–	1	–	–
Other diseases of the buccal cavity and adnexa	–	10	–	–	1	2	–	–	1	4	–	3	–	–	–	1	–	–	–	–
Diseases of the pharynx and tonsils (including adenoids):																				
Streptococcic sore throat	–	–	–	–	–	2	–	–	–	–	–	–	3	1	1	2	–	–	–	–
Ludwig's angina	–	–	–	1	–	5	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Tonsilitis	3	2	–	4	1	16	3	5	2	4	1	13	3	3	5	4	–	–	–	–
Adenoids	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	1	–	–	–	–
Others	–	1	–	–	–	1	–	–	–	3	–	–	–	–	–	–	–	–	–	–
Diseases of the oesophagus	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Ulcer of the stomach and duodenum:																				
Ulcer of the stomach	–	3	–	–	–	–	–	–	–	–	–	–	–	–	1	–	1	–	–	–
Ulcer of the duodenum	–	–	–	1	–	–	–	–	–	2	–	–	–	–	–	–	–	–	–	–
Other diseases of the stomach (cancer excepted):																				
Indigestion	3	25	1	7	1	11	1	–	1	15	–	4	12	9	13	12	–	–	–	–
Gastritis	2	9	1	–	2	19	1	–	–	–	–	1	–	–	–	–	–	–	–	–
Stricture or stenosis of pylorus	1	3	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Others	–	5	–	–	–	2	–	–	–	3	–	–	–	–	–	–	–	–	–	–
Diarrhoea and enteritis (under 2 years of age)	–	–	–	9	–	–	–	1	–	–	–	2	–	–	–	3	–	–	–	–
Diarrhoea and enteritis (2 years and over)	–	11	1	3	1	40	1	–	–	30	–	7	3	15	7	11	–	–	–	1
Ankylostomiasis	–	18	–	2	–	107	–	1	2	111	–	31	1	11	1	6	–	–	–	–
Diseases due to other intestinal parasites:																				
Cestodes (hydatids of the liver excepted)	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–
Trematodes	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Filariasis	–	–	–	–	–	3	–	–	–	–	–	–	–	–	–	–	–	–	–	–

TREATED IN HOSPITALS—*Continued*

Panama Division				Preston Division				Tela Railroad				Truxillo Railroad				Semi-total					Deaths in Hospitals			
Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.			Emp.		Non-Emp.	
T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	Total	T.	O.	T.	O.
1	5	–	–	2	1	–	3	–	2	–	1	1	11	–	3	4	22	1	9	36	–	–	–	–
–	–	–	–	–	1	–	1	1	4	–	–	–	3	–	–	1	12	–	3	16	–	–	–	–
–	4	–	–	–	–	–	–	–	2	–	–	–	1	–	–	–	17	–	7	24	–	1	–	–
–	70	–	12	4	43	1	6	2	59	9	25	5	36	–	11	18	390	15	91	514	–	–	–	–
–	10	–	1	1	3	–	–	–	1	–	4	–	3	–	–	1	38	1	11	51	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	1	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	4	–	2	–	5	–	2	7	–	–	–	–
–	7	–	6	–	6	–	5	–	8	–	14	–	14	–	4	3	111	–	59	173	2	21	–	11
–	–	–	–	–	–	–	–	–	–	1	4	–	–	–	–	–	–	1	4	5	–	–	–	–
–	27	–	10	–	34	–	5	–	56	–	7	–	51	–	12	2	371	3	66	442	–	97	1	26
–	–	–	–	–	–	–	–	–	1	–	1	–	1	–	–	–	9	–	1	10	–	2	–	1
–	25	1	5	–	16	–	1	2	28	1	1	–	9	–	–	4	124	2	12	142	–	–	–	–
–	–	–	–	–	4	–	1	–	3	–	–	–	1	–	–	–	12	–	2	14	–	2	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	1	–	–	–	–	–	–	–	–	–	1	1	–	1	2	1	2	6	–	1	–	2
1	9	–	3	–	9	2	2	–	3	1	1	1	4	1	–	4	71	6	15	96	–	–	–	1
–	–	–	–	–	3	–	–	–	–	–	–	–	–	–	–	1	3	–	–	4	–	–	–	–
–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	1	1	1	3	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	1	–	–	–	7	–	–	5	16	2	7	–	2	–	–	6	36	2	8	52	–	3	–	–
1	15	–	3	–	30	–	1	1	6	2	3	–	29	–	2	5	180	5	20	210	–	–	–	–
–	5	–	2	2	9	–	4	–	2	1	1	–	2	–	–	4	34	1	11	50	–	–	–	–
–	–	–	–	–	2	–	–	–	–	–	–	–	1	1	–	3	6	2	2	13	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	5	–	1	6	–	–	–	–
–	5	–	21	2	12	1	24	1	7	8	14	2	3	1	2	14	52	19	87	172	–	–	–	–
–	–	–	–	–	–	–	–	–	1	–	2	–	–	–	–	–	1	1	3	5	–	–	–	–
–	13	–	4	–	3	–	2	–	2	2	1	–	1	–	1	–	24	2	8	34	–	1	–	–
–	–	–	–	–	–	–	–	–	–	–	3	–	–	–	–	–	–	–	3	3	–	–	–	–
–	1	–	–	–	1	–	–	–	–	–	1	–	–	–	–	1	5	1	1	8	–	–	–	–
–	–	–	–	–	1	2	–	–	–	–	1	–	–	–	–	–	3	2	2	7	–	–	–	1
–	1	–	2	1	–	–	1	1	7	2	2	7	6	2	7	26	74	19	35	154	–	–	–	–
–	12	–	7	2	4	1	2	1	3	–	–	1	–	–	1	8	47	3	11	69	–	–	–	–
–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	1	3	1	–	5	–	–	–	–
–	–	–	–	–	1	–	–	1	–	–	–	1	1	–	–	2	12	–	–	14	–	–	–	–
–	–	–	–	–	–	–	8	–	–	1	6	–	–	–	9	–	–	1	38	39	–	–	–	7
1	7	–	2	1	7	–	3	3	43	1	9	5	14	3	3	14	167	13	39	233	–	–	–	–
6	65	2	32	–	10	–	1	–	9	1	8	–	29	–	15	9	360	4	96	469	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	1	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	1	–	–	–	–
–	–	–	–	–	1	–	–	–	–	–	1	–	–	–	–	–	4	–	1	5	–	–	–	–

CLASSIFICATION OF DISEASES

	Banes Division				Colombia Division				Costa Rica Division				Guatemala Division				Jamaica Division			
	Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.	
	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.
Diseases of the Digestive System: *—Continued*																				
Ascariasis	–	1	–	–	–	3	–	–	–	4	–	2	–	–	–	–	–	–	–	–
Trichocephalus	–	–	–	1	–	1	–	1	–	2	–	1	–	–	–	1	–	–	–	–
Nematodes not specified	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Parasites not specified	–	–	–	–	1	8	–	–	–	15	–	1	–	–	–	–	–	–	–	–
Appendicitis and typhlitis	1	12	–	13	1	10	2	4	2	6	3	5	2	8	2	11	–	1	2	–
Hernia, intestinal obstruction:																				
Hernia	2	11	–	4	1	57	2	4	–	20	–	5	3	4	1	1	–	–	–	–
Intestinal obstruction	–	2	–	4	–	1	–	–	–	1	–	–	–	1	–	–	–	–	–	–
Other diseases of the intestines:																				
Diseases of the anus and stercoral fistulae	–	2	–	–	–	2	–	2	1	2	–	4	–	1	–	1	–	–	–	–
Other diseases of the intestines	–	14	1	2	2	19	–	3	2	12	1	2	–	–	–	1	–	–	–	–
Acute yellow atrophy of the liver	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Hydatid tumor of the liver	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–
Cirrhosis of the liver:																				
Returned as alcoholic	–	–	–	–	–	–	–	–	–	–	–	1	–	2	–	–	–	–	–	–
Not returned as alcoholic	–	1	–	–	–	11	–	1	–	–	–	1	–	1	–	2	–	–	–	–
Biliary calculi	–	1	–	–	–	–	1	1	–	3	–	2	–	–	1	–	–	–	–	–
Other diseases of the liver:																				
Abscess of the liver, amebic	–	–	–	–	–	2	–	2	–	–	–	2	–	–	–	–	–	–	–	–
Other diseases of the liver	–	6	–	2	–	61	1	3	3	32	–	4	–	–	–	–	1	–	–	–
Diseases of the pancreas except cancer	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Peritonitis of unstated cause	–	–	–	–	–	3	–	2	–	2	–	2	–	–	–	–	–	–	–	–
Other diseases of the digestive system (Cancer and tuberculosis excepted)	–	–	–	–	–	6	–	1	–	–	–	–	–	–	–	–	–	–	–	–
Non-Venereal Diseases of the Genito-Urinary System and its Adnexa:																				
Acute nephritis (including unspecified, under ten years of age)	–	–	–	1	–	3	–	–	–	1	–	4	–	–	–	–	–	–	–	–
Chronic nephritis (including unspecified, over ten years of age)	–	19	–	5	–	21	–	7	–	20	–	8	–	10	2	1	–	1	–	–
Chyluria	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Other diseases of the kidneys and their adnexa (diseases of the kidney in pregnancy not included)	–	2	–	3	–	18	–	4	–	2	–	4	–	–	–	–	–	–	–	–
Calculi of the urinary passages	–	1	–	–	–	2	2	–	–	–	–	–	–	–	–	–	–	2	1	–
Diseases of the bladder (except tumors)	–	1	–	5	–	5	–	3	–	14	–	5	–	2	–	4	–	–	1	–
Diseases of the urethra, urinary abscess, etc.:																				
Stricture of the urethra	–	4	–	–	–	11	–	2	–	6	–	3	–	3	–	–	–	–	1	–
Others	–	–	–	–	–	–	–	–	–	1	–	1	–	–	–	–	–	–	–	–
Diseases of the prostate (except tumors)	–	3	1	1	–	1	–	1	–	2	–	1	–	–	–	–	–	–	–	–
Non-venereal diseases of the male genital organs	–	21	–	4	1	14	–	3	1	24	1	10	–	4	2	3	–	–	–	–
Cysts and other benign tumors of the ovary	–	1	–	4	–	1	–	2	–	–	–	–	–	1	–	3	–	–	–	–
Salpingitis, or pelvic abscess	–	–	–	10	–	10	1	20	–	–	–	3	–	3	–	12	–	–	–	1
Benign tumors of the uterus	–	–	–	8	–	2	–	3	–	–	–	–	–	–	–	–	–	–	–	–
Non-puerperal uterine hemorrhage	–	1	–	2	–	5	–	2	–	–	–	–	–	–	–	–	–	–	–	–
Metritis	–	–	–	3	–	1	–	–	–	2	1	6	–	–	–	–	–	–	–	–
Other diseases of the female genital organs	–	–	–	6	–	6	–	12	–	5	1	36	–	1	5	16	–	–	–	–
Non-puerperal diseases of the breast (cancer excepted)	–	–	–	3	–	–	–	–	–	2	–	–	–	–	–	–	–	–	–	–
The Puerperal State:																				
Accidents of pregnancy:																				
Abortion	–	1	–	11	–	6	–	6	–	1	1	14	–	–	–	2	–	–	–	–
Ectopic gestation	–	–	–	2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Other accidents of pregnancy	–	–	1	7	–	2	–	3	–	–	–	10	–	–	–	4	–	–	–	–
Puerperal hemorrhage	–	–	–	3	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Other accidents of childbirth:																				
Caesarian section	–	–	–	–	–	–	–	1	–	–	–	2	–	–	–	–	–	–	–	–

TREATED IN HOSPITALS—*Continued*

Panama Division				Preston Division				Tela Railroad				Truxillo Railroad				Semi-Total					Deaths in Hospitals			
Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.			Emp.		Non-Emp.	
T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	Total	T.	O.	T.	O.
–	–	–	2	–	–	–	–	–	1	1	21	–	3	1	14	–	12	2	39	53	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	3	–	5	8	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	1	18	–	3	1	–	–	–	–	1	–	–	3	42	–	4	49	–	–	–	–
1	1	1	1	2	6	1	4	2	1	2	5	1	3	–	3	12	48	13	46	119	1	–	1	3
–	23	1	5	2	17	–	–	2	9	–	2	–	10	–	2	10	151	4	23	188	–	1	–	–
–	–	–	1	–	–	–	–	–	2	–	1	–	–	–	1	–	7	–	7	14	–	2	–	2
2	2	–	1	–	4	–	1	–	1	–	1	1	3	–	1	4	17	–	11	32	–	–	–	–
1	10	–	4	–	–	–	–	1	2	1	3	3	1	–	2	9	58	3	17	87	–	2	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	1	–	–	–	–
–	–	–	–	–	–	–	–	–	1	–	–	–	1	–	–	–	4	–	1	5	–	–	–	–
–	–	–	1	–	1	–	–	–	2	–	1	1	2	–	–	1	18	–	6	25	1	1	–	–
–	2	–	2	–	–	–	–	–	–	–	2	–	3	1	–	–	9	3	7	19	–	–	1	1
–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	1	–	3	–	5	8	–	–	–	–
–	3	–	1	1	1	–	–	3	25	1	7	–	5	–	1	8	133	2	18	161	–	1	–	1
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	3	–	1	–	2	–	2	–	–	–	1	–	–	–	–	–	10	–	8	18	–	8	–	6
–	8	1	2	–	1	–	1	–	1	–	2	2	10	–	2	2	26	1	8	37	–	–	–	1
–	8	–	1	2	4	–	–	–	4	2	–	–	4	–	–	2	24	2	6	34	–	–	–	–
2	25	1	6	1	7	–	2	–	16	–	2	1	5	–	–	4	124	3	31	162	2	18	–	2
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
2	2	–	2	–	3	5	9	–	–	2	2	–	–	2	–	2	27	9	24	62	–	2	–	1
–	–	–	–	–	–	–	1	–	2	2	–	1	–	–	–	1	7	5	1	14	–	–	–	–
–	2	–	2	–	5	–	4	–	1	1	3	1	2	–	3	1	32	2	29	64	–	–	–	–
1	16	–	3	1	15	–	–	–	5	1	3	–	4	–	–	2	64	2	11	79	–	2	1	–
–	8	–	1	–	2	–	–	–	–	–	–	1	–	–	–	1	11	–	2	14	–	–	–	–
–	3	–	–	–	1	–	1	–	1	–	–	–	2	–	1	–	13	1	5	19	–	–	1	–
4	10	–	14	–	24	–	2	1	8	–	3	1	2	–	2	8	107	3	41	159	–	–	–	–
–	–	–	–	–	–	–	4	–	–	–	–	–	–	1	2	–	3	1	15	19	–	–	–	–
–	–	–	1	–	1	–	6	–	3	1	15	–	1	–	2	–	18	2	70	90	–	–	–	1
–	–	–	4	–	1	–	2	–	–	1	6	–	–	–	–	–	3	1	23	27	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	7	–	4	11	–	–	–	–
–	–	–	–	–	1	–	1	–	4	–	22	–	–	–	–	–	8	1	32	41	–	–	–	–
–	8	2	18	–	2	4	4	1	1	7	15	–	–	–	3	1	23	19	110	153	–	–	–	1
–	1	–	3	–	–	–	–	–	–	–	–	–	–	1	1	–	3	1	7	11	–	–	–	–
–	–	–	11	–	–	1	5	–	2	2	11	–	–	1	5	–	10	5	65	80	–	–	–	2
–	–	–	1	–	–	–	1	–	–	–	2	–	–	–	–	–	–	–	6	6	–	–	–	–
–	1	–	5	–	–	1	3	–	–	–	5	–	–	2	3	–	3	4	40	47	–	–	–	2
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	3	3	–	–	–	1
–	–	–	–	–	–	–	–	–	–	–	2	–	–	–	–	–	–	–	5	5	–	–	–	–

CLASSIFICATION OF DISEASES

	Banes Division				Colombia Division				Costa Rica Division				Guatemala Division				Jamaica Division			
	Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.	
	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.
The Puerperal State—*Continued*																				
Other surgical operations and instrumental delivery	–	–	–	6	–	–	–	4	–	–	–	1	–	–	–	1	–	–	–	–
Others	–	–	4	12	–	–	–	5	–	–	–	2	–	–	–	1	–	–	–	–
Phlegmasia alba dolens, puerperal embolism, etc.	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Puerperal septicemia	–	–	–	1	–	–	–	1	–	–	–	2	–	–	–	–	–	–	–	–
Puerperal albuminuria or convulsions	–	–	–	2	–	–	–	–	–	–	–	2	–	–	–	1	–	–	–	–
Childbirth (without other explanation)	–	–	5	16	–	4	5	26	–	–	4	36	–	–	1	13	–	–	–	–
Puerperal diseases of the breast	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Diseases of the Skin or Cellular Tissue:																				
Gangrene	–	1	–	–	–	4	–	–	–	4	–	–	–	–	–	–	–	–	–	–
Boil, carbuncle, furuncle	–	11	–	6	2	35	1	2	–	23	–	10	6	29	3	13	1	–	–	–
Phlegmon, acute abscess	1	57	–	12	2	145	–	9	2	16	–	14	2	47	2	48	–	2	2	–
Tinea and alopecia	–	1	–	–	–	3	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Pruritis (morbidity only)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Other diseases of the skin and its adnexa:																				
Trichophytosis	–	1	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Scabies	–	7	1	3	–	4	–	–	–	8	–	3	–	–	–	2	–	–	–	–
Chiggers (*pulex penetrans*)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Red bug	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Pemphigus contagiosus	–	1	–	–	–	–	–	1	–	3	–	–	–	–	–	–	–	–	–	–
Mycetoma	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Ground itch	–	–	–	–	–	2	–	–	1	–	–	–	2	7	–	3	–	–	–	–
Filariasis	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–
Elephantiasis	–	–	–	–	–	2	–	–	–	–	1	–	–	–	–	–	–	–	–	–
Myiosis of skin	1	1	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–
Dhobie itch	–	–	–	–	–	3	–	–	–	3	1	2	–	–	–	–	1	–	–	–
Prickly heat	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–
Ulcer of the skin	1	46	–	2	1	114	–	2	–	55	–	12	1	63	–	19	–	–	–	–
Ainhum	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–
Ulcerating granuloma of the pudenda	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Impetigo contagiosa	–	–	–	1	–	3	–	1	–	–	–	–	–	5	–	–	–	–	–	–
Urticaria	–	–	–	–	–	1	–	–	–	1	–	1	–	–	–	1	–	–	–	–
Other diseases of the skin and adnexa	–	27	–	1	2	53	–	2	10	131	1	35	2	45	2	9	1	–	–	–
Diseases of the Bones and Organs of Locomotion:																				
Diseases of the bones (tuberculosis excepted)	–	–	–	–	–	15	–	1	–	3	1	1	–	2	1	–	–	–	–	–
Diseases of the joints (tuberculosis and rheumatism excepted)	–	1	–	–	–	36	–	3	–	7	–	1	–	4	–	1	–	–	–	–
Other diseases of the bones or organs of locomotion	–	–	–	–	–	–	–	–	–	5	–	–	–	–	–	–	–	–	–	–
Malformations:																				
Congenital malformations (stillbirths excepted):																				
Hydrocephalus	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Malformations of heart	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Others	–	–	–	–	–	2	–	–	–	2	–	–	–	–	–	–	–	–	–	–
Diseases of Early Infancy:																				
Congenital debility, icterus and sclerema:																				
Marasmus	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Inanition	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	2	–	–	–	–
Icterus	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Sclerema	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Others	–	–	–	4	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–
Premature birth, or consequence of labor:																				
Premature birth	–	–	–	–	–	–	–	1	–	–	–	2	–	–	–	–	–	–	–	–
Injury at birth	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–

TREATED IN HOSPITALS—*Continued*

Panama Division				Preston Division				Tela Railroad				Truxillo Railroad				Semi-Total					Deaths in Hospitals			
Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.			Emp.		Non-Emp.	
T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	Total	T.	O.	T.	O.
–	–	–	2	–	–	–	4	–	–	1	3	–	–	–	–	–	–	1	21	22	–	–	–	2
–	–	–	1	–	–	–	–	–	–	–	7	–	–	–	–	–	–	4	28	32	–	–	–	2
–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	1	1	–	–	–	–
–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	2	–	–	–	7	7	–	–	–	4
–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	4	–	–	–	10	10	–	–	–	6
–	–	4	48	–	–	2	19	–	2	31	149	–	–	5	35	–	6	57	342	405	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	2	–	–	–	1	–	–	–	1	–	–	–	–	–	9	–	4	13	–	6	–	1
4	12	–	6	–	5	–	2	2	21	–	3	8	30	–	3	23	166	4	45	238	–	–	–	1
–	43	–	6	–	47	1	3	6	108	3	15	8	85	2	15	21	550	10	122	703	–	2	–	–
–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	4	–	1	5	–	–	–	–
–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	1	–	–	1	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	4	–	1	–	6	–	1	7	–	–	–	–
–	–	–	–	–	7	–	1	1	4	–	–	–	3	–	1	1	33	1	10	45	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	2	–	–	–	–	–	–	–	2	4	–	1	7	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	2	–	2	1	10	–	–	4	21	–	5	30	–	–	–	–
–	–	–	–	–	–	–	–	–	1	–	–	–	1	–	–	–	3	–	–	3	–	–	–	–
–	2	–	–	–	2	–	–	–	–	–	–	–	–	–	–	–	6	1	–	7	–	–	–	–
5	9	–	–	–	–	–	–	–	–	–	–	–	1	–	–	6	12	–	–	18	–	–	–	–
–	3	–	–	–	–	–	–	–	1	–	–	–	1	–	–	1	11	1	2	15	–	–	–	–
–	–	–	–	–	–	–	–	1	–	–	1	–	–	–	–	1	–	–	2	3	–	–	–	–
–	49	–	2	–	96	–	3	–	7	–	1	2	100	–	9	5	530	–	50	585	–	–	–	–
–	2	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	3	–	1	4	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	1	–	3	–	–	–	4	–	1	5	–	–	–	–
1	4	–	1	–	1	–	–	–	–	–	1	–	1	–	1	1	14	–	5	20	–	–	–	–
–	–	–	–	–	–	–	–	–	5	–	–	–	–	–	–	–	7	–	2	9	–	–	–	–
5	46	–	16	–	9	–	1	1	67	2	17	2	41	–	2	23	419	5	83	530	–	–	–	1
1	5	–	2	–	5	–	1	–	5	1	2	–	4	–	2	1	39	3	9	52	–	–	–	–
2	53	–	13	–	19	1	3	–	18	2	1	–	15	–	4	2	153	3	26	184	–	–	–	–
–	1	–	–	–	1	–	–	1	30	–	5	–	4	–	1	1	41	–	6	48	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	4	1	–	5	–	–	–	–
–	–	–	1	–	–	–	–	–	–	–	2	–	–	–	4	–	–	–	7	7	–	–	–	1
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	4	4	–	–	–	1
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	1	–	–	–	–	–	–	1	1	–	–	–	1	–	–	1	8	9	–	–	–	2
–	–	–	2	–	–	–	–	–	–	–	2	–	–	–	3	–	–	–	10	10	–	–	–	3
–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	1	1	–	–	–	1

CLASSIFICATION OF DISEASES

	Banes Division				Colombia Division				Costa Rica Division				Guatemala Division				Jamaica Division		
	Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non Emp
	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.
Diseases of Early Infancy: —*Continued*																			
Other diseases peculiar to early infancy:																			
Asphyxia neonatorum	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Atalectasis	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Umbilical infection	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Umbilical hemorrhage	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Others	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–
Lack of care	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Old Age:																			
Old age (senility)	–	2	–	–	–	–	–	–	1	1	–	1	–	–	–	–	–	–	–
External Causes:																			
Suicide	–	–	–	3	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Poisoning by food	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–
Poisoning by venomous animals	–	–	–	–	–	1	–	–	–	6	–	3	–	3	–	–	–	–	–
Other acute poisonings	–	–	–	–	–	2	–	–	–	3	–	5	–	–	–	1	–	–	–
Burns and scalds	–	2	–	–	–	11	–	2	–	6	–	5	–	6	1	3	–	–	–
Mechanical suffocation	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Absorption of irrespirable or poisonous gas	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Accidental drowning	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Injury by fire-arms	–	3	–	3	–	13	–	6	–	7	–	13	1	6	–	7	–	–	–
Injury by cutting or piercing instruments	3	214	1	10	1	90	–	4	1	126	–	49	2	108	4	24	–	–	–
Injury by falls	–	8	–	–	1	7	2	2	2	42	–	10	6	35	8	14	1	1	1
Traumatism by machines	1	14	1	1	–	2	–	1	–	3	–	1	–	7	2	12	–	–	–
Traumatism by other crushing (vehicles, railways, landslides, etc.)	1	22	3	3	–	17	–	6	7	39	1	4	2	16	2	15	–	–	1
Injuries by animals (not poisoning)	–	1	–	2	–	4	–	–	–	1	–	2	–	2	–	–	–	–	1
Over-exertion	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–
Starvation	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Effects of heat	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–
Lightning	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Electricity	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–
Homicide by fire-arms	–	–	–	–	–	2	–	–	–	–	–	–	–	2	–	–	–	–	–
Homicide by cutting or piercing instruments	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Homicide by other means	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Infanticide	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Dislocations	2	2	–	–	–	2	–	–	–	2	–	2	–	–	–	–	–	–	–
Sprains	–	10	–	–	–	3	–	–	–	4	–	1	–	–	–	–	–	–	–
Fractures (cause not specified)	–	1	–	1	1	18	1	3	–	20	1	16	–	14	2	8	–	1	–
Other external violence:																			
Criminal abortion	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Explosions	–	–	–	1	–	5	–	2	–	–	–	1	–	–	–	–	–	–	–
Salvarsan injection	–	–	–	–	–	–	–	–	3	184	2	4	–	–	–	–	–	–	–
Other medicaments (injections)	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–
Other external violence	–	–	–	–	2	93	–	2	4	86	–	31	2	21	1	15	–	–	–
Ill-Defined Diseases:																			
Sea-sickness	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–
Ill-defined organic diseases	–	–	–	–	1	3	–	–	–	–	–	–	–	–	–	–	–	–	–
Sudden death	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–
No disease; malingering	–	6	–	–	–	11	–	41	2	19	7	57	2	1	3	38	–	–	–
Infections of undetermined origin	–	2	–	1	–	12	–	–	–	–	–	–	–	2	–	–	–	–	–
TOTAL	135	3,385	32	493	73	3,392	38	325	116	3,707	83	1,327	151	2,415	165	1,335	18	18	23

NOTE: This table gives only *cases* treated in our hospitals and does not show the *number of treatments*.

TREATED IN HOSPITALS—*Concluded*

Panama Division				Preston Division				Tela Railroad				Truxillo Railroad				Semi-Total					Deaths in Hospitals			
Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.			Emp.		Non-Emp.	
T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	Total	T.	O.	T.	O.
–	–	–	–	–	–	–	–	–	–	–	2	–	–	–	–	–	–	–	2	2	–	–	–	2
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	2	2	–	–	–	1
–	–	–	2	–	–	–	–	–	–	1	–	–	–	–	–	–	–	1	2	3	–	–	–	–
–	1	–	1	1	–	–	–	1	–	–	1	–	–	–	–	3	4	–	3	10	–	1	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	3	3	–	–	–	3
1	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	2	1	–	–	3	–	–	–	–
–	5	–	4	–	–	–	–	–	6	–	–	–	1	–	–	–	22	–	7	29	–	–	–	2
–	1	–	1	–	–	–	1	1	–	–	2	–	–	–	–	1	6	–	10	17	–	–	–	1
–	4	–	1	–	4	1	5	–	3	1	2	1	5	–	2	1	41	3	20	65	–	3	–	4
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	6	–	4	–	6	1	3	–	12	2	14	1	17	–	6	2	70	3	56	131	–	2	–	6
–	72	–	10	1	99	2	5	–	72	–	19	1	98	–	1	9	879	7	122	1,017	–	3	–	–
2	24	1	8	–	–	–	–	4	20	–	5	3	28	1	7	19	165	13	46	243	1	1	1	–
–	1	2	–	–	3	–	–	–	4	–	2	–	6	–	1	1	40	5	18	64	–	1	–	–
1	17	–	6	–	10	1	–	8	41	2	9	1	15	1	–	20	177	11	43	251	–	6	2	3
–	–	–	–	–	–	–	–	–	11	–	1	–	6	–	–	–	25	1	5	31	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	2	–	–	–	2	1	–	–	3	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	1	–	1	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	1	1	–	–	2	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	1	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	2	–	–	–	–	–	4	–	2	6	–	4	–	2
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	2	–	3	–	1	–	–	–	–	–	1	–	–	2	10	–	5	17	–	–	–	–
1	1	–	1	1	4	–	–	1	–	–	–	–	2	–	–	3	24	–	2	29	–	–	–	–
1	2	–	–	–	15	1	11	–	5	–	–	1	11	1	–	3	87	6	39	135	–	2	–	3
–	–	–	–	–	–	–	1	–	–	–	–	–	1	–	–	–	1	–	1	2	–	–	–	1
–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	5	–	5	10	–	–	–	–
–	–	–	–	–	–	–	–	–	2	–	–	–	1	–	1	3	187	2	5	197	–	–	–	–
–	–	–	–	–	–	–	1	–	–	–	–	1	–	–	–	1	1	–	1	3	–	–	–	–
5	56	1	10	2	91	1	7	1	1	–	2	1	4	–	–	17	352	3	67	439	–	–	–	1
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	1	–	–	–	–
–	–	–	–	–	–	–	–	1	9	2	9	–	1	–	–	2	13	2	9	26	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	1	–	1	–	–
–	7	2	77	5	38	3	21	6	24	9	48	2	3	1	58	17	109	25	340	491	–	–	–	–
–	4	–	3	1	3	–	2	2	27	3	11	–	–	–	–	3	50	3	17	73	–	3	–	2
111	1,859	30	798	66	2,117	42	369	121	2,212	171	937	143	2,000	47	443	934	21,105	631	6,032	28,702	15	448	15	259

CLASSIFICATION OF DISEASES TREATED

	Banes Division				Colombia Division				Costa Rica Division				Guatemala Division				Jamaica Division			
	Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.	
	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.
Endemic or Infectious Diseases:																				
Malaria or cachaexia (No. 5)	168	2,650	154	3,438	40	4,044	5	216	118	2,174	38	542	484	3,167	194	1,158	98	410	29	38
Influenza (No. 11)	50	748	68	684	30	2,739	3	117	58	469	22	108	9	85	1	15	44	424	40	37
Dysentery (No. 16)	20	44	–	65	18	2,202	8	272	7	187	4	70	–	15	–	–	5	22	2	–
Venereal infections (Nos. 38 to 40, inc.)	13	179	–	42	12	1,858	6	155	35	1,418	15	336	–	129	1	82	–	117	20	3
Other endemic or infectious diseases (Nos. 1 to 42, inc., excepting Nos. 5, 11, 16, and 38 to 40)	31	89	7	296	1	117	–	61	9	224	2	76	–	–	–	–	1	63	18	23
General Diseases not Included Above:																				
Cancer (Nos. 43 to 49, inc.)	–	1	–	–	–	2	–	3	–	2	–	5	–	–	–	–	1	–	12	–
Benign tumors, and tumors not returned as malignant (No. 50)	–	21	1	17	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1
Rheumatism or gout (Nos. 51 and 52)	64	360	–	113	4	1,284	–	43	44	1,368	21	117	34	172	21	30	2	157	22	12
Anaemia: chlorosis (No. 58)	46	200	67	648	1	508	2	33	2	139	1	68	–	–	–	–	34	159	54	52
Other general diseases (Nos. 43 to 69, inc., excepting Nos. 43 to 52 inc., and No. 58)	8	18	17	42	–	30	1	47	–	127	3	64	–	–	–	–	1	25	6	5
Diseases of the Nervous System and Organs of Special Sense:																				
Diseases of the nervous system (Nos. 70 to 84, inc.)	14	119	8	197	3	1,186	1	89	18	300	14	61	–	–	–	1	12	143	26	12
Diseases of the organs of vision, and adnexa (No. 85)	36	204	–	129	13	724	1	30	18	449	10	71	9	80	10	38	8	81	6	9
Diseases of the organs of hearing and the mastoid process (No. 86)	28	88	4	51	6	138	–	27	19	173	6	50	2	84	1	25	8	33	24	15
Diseases of the Circulatory System:																				
Organic diseases of the heart (Nos. 87 to 90, inc.)	1	23	–	52	–	5	–	8	–	81	6	31	–	–	–	–	–	37	10	–
Other diseases of the circulatory system (Nos. 87 to 96, inc., excepting Nos. 87 to 90, inc.)	5	66	–	49	–	75	–	4	7	227	3	55	–	–	–	–	12	28	14	5
Diseases of the Respiratory System:																				
Bronchitis (No. 99)	131	537	92	578	8	752	5	101	77	980	31	175	46	223	21	74	1	2	–	–
Pneumonia and pleurisy (Nos. 100 to 102, inc.)	–	38	–	9	1	34	–	9	–	4	–	4	–	–	–	–	–	28	4	3
Other diseases of the respiratory system (Nos. 97 to 107, inc., excepting Nos. 99 to 102, inc.)	9	53	4	126	3	207	1	27	4	297	2	51	–	4	–	–	5	26	2	6
Diseases of the Digestive System:																				
Diseases of the mouth and adnexa (No. 108)	2	124	1	191	3	540	–	33	15	294	4	55	5	137	–	43	3	37	16	1
Diarrhoea and enteritis (Nos. 113 and 114)	13	42	69	485	–	303	3	32	8	172	5	89	–	14	1	16	5	20	6	3
Ankylostomiasis (No. 115)	–	5	–	34	6	361	–	59	1	255	1	39	–	–	–	–	–	4	–	3
Other diseases of the digestive system (Nos. 108 to 127, inc., excepting No. 108 and Nos. 113 to 115, inc.)	199	907	104	1,071	40	2,869	17	330	102	1,776	35	317	123	110	101	95	91	380	79	102

IN HOSPITAL DISPENSARIES

Panama Division				Preston Division				Tela Railroad				Truxillo Railroad				Semi-total				
Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.		
T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	Total
–	–	–	–	68	1,183	19	2,282	442	1,044	285	497	42	515	13	167	1,460	15,187	737	8,338	25,722
–	–	–	–	32	176	10	329	168	495	112	207	–	1	2	–	391	5,137	258	1,497	7,283
–	–	–	–	3	2	–	1	11	119	9	38	–	–	–	–	64	2,591	23	446	3,124
–	–	–	–	31	255	6	122	248	752	78	337	30	356	6	52	369	5,064	132	1,129	6,694
–	–	–	–	2	68	1	163	2	26	17	25	3	–	3	2	49	587	48	646	1,330
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	7	1	5	12	15	33
–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	1	–	21	1	20	42
–	–	–	–	3	177	1	102	4	39	1	9	7	176	2	23	162	3,733	68	449	4,412
–	–	–	–	–	31	–	149	–	7	1	5	7	8	5	20	90	1,052	130	975	2,247
–	–	–	–	33	227	30	234	154	384	126	174	–	–	–	–	196	811	183	566	1,756
–	–	–	–	11	152	12	214	11	66	8	27	15	77	5	22	84	2,043	74	623	2,824
–	–	–	–	36	404	4	117	10	155	15	34	50	203	12	44	180	2,300	58	472	3,010
–	–	–	–	2	29	10	63	20	124	10	34	23	41	16	33	108	710	71	298	1,187
–	–	–	–	4	25	–	79	–	2	–	–	–	–	–	2	5	173	16	172	366
–	–	–	–	–	21	1	59	86	285	82	129	11	29	2	12	121	731	102	313	1,267
–	–	–	–	85	543	25	752	20	94	8	42	40	500	34	115	408	3,631	216	1,837	6,092
–	–	–	–	–	11	–	3	4	43	4	15	1	–	–	1	6	158	8	44	216
–	–	–	–	14	42	2	125	81	315	79	106	47	378	10	60	163	1,322	100	501	2,086
–	–	–	–	9	115	8	143	53	104	27	52	5	161	9	27	95	1,512	65	545	2,217
–	–	–	–	5	40	2	413	18	54	31	66	7	29	1	34	56	674	118	1,138	1,986
–	–	–	–	–	7	–	–	18	88	30	61	–	3	–	6	25	723	31	202	981
–	–	–	–	74	902	56	1,203	396	995	242	433	176	709	54	230	1,201	8,648	688	3,781	14,318

CLASSIFICATION OF DISEASES TREATED

	Banes Division				Colombia Division				Costa Rica Division				Guatemala Division				Jamaica Division			
	Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.	
	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.
Non-Venereal Diseases of the Genito-Urinary System and its Adnexa:																				
Nos. 128 to 142, inc.	90	171	13	551	–	453	5	204	13	476	5	345	–	–	–	–	10	149	43	70
The Puerperal State:																				
Nos. 143 to 150, inc.	–	3	17	230	–	–	1	1	–	4	1	104	–	–	–	–	–	2	–	2
Diseases of the Skin and of the Cellular Tissue:																				
Boil, carbuncle, furuncle (No. 152)	66	214	60	142	3	290	2	62	10	199	9	30	18	29	–	10	3	88	28	16
Phlegmon, acute abscess (No. 153)	36	634	51	516	4	990	2	134	7	118	4	28	47	220	–	297	4	56	7	5
Ground itch	–	–	–	6	–	–	–	–	–	7	–	–	–	–	–	–	–	1	–	–
Ulcer of the skin	1	187	–	94	–	3,712	–	19	21	178	1	31	31	1,000	4	392	–	88	4	2
Other diseases of the skin or cellular tissue, and adnexa (Nos. 151 to 154, inc., excepting Nos. 152 and 153, and "Ground Itch" and "Ulcer of the Skin.")	45	423	28	484	23	1,432	4	115	70	791	18	176	82	13	23	9	33	36	18	17
Diseases of the Bones and Organs of Locomotion:																				
Nos. 155 to 158, inc.	–	5	–	–	–	15	–	3	2	17	1	–	–	–	–	–	–	2	1	–
Malformations:																				
No. 159	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1
Diseases of Early Infancy:																				
Nos. 160 to 163, inc.	–	–	–	43	–	–	–	1	–	–	–	2	–	–	–	–	–	–	–	9
Old Age																				
No. 164	–	6	–	1	–	–	–	–	–	4	–	–	–	–	–	–	–	1	2	–
External Causes:																				
Injury by fire-arms (No. 183)	–	2	–	–	–	28	–	2	–	2	–	6	–	15	–	–	–	2	–	–
Injury by cutting or piercing instruments and falls (Nos. 184 and 185)	185	2,331	41	431	15	1,892	4	50	26	552	1	85	9	255	–	83	4	573	36	7
Traumatism by machines and other means (Nos. 187 and 188)	85	264	–	63	–	326	–	–	26	177	6	53	–	–	–	–	4	915	12	4
Dislocations, sprains, fractures (No. 201)	8	91	2	36	–	32	–	1	1	93	3	13	–	1	–	–	–	75	8	3
Other external causes (Nos. 165 to 203, inc., excepting Nos. 183 to 185, inc., 187, 188 and 201)	17	214	9	72	–	384	1	7	39	1,122	18	171	23	128	7	56	20	79	79	1,267
Ill-Defined Diseases:																				
Nos. 204 and 205	–	93	5	40	–	24	2	45	17	98	29	475	–	–	–	–	11	63	140	129
TOTAL	1,371	11,154	822	11,026	234	29,556	74	2,340	774	14,954	319	3,903	922	5,881	385	2,424	420	4,326	768	1,862

NOTE. This table shows the number of treatments, and not the number of cases treated, in our hospital dispensaries..

The chart numbers used are taken from the "International List of Causes of Sickness and Death." These chart numbers are used universally by public-health and city and state health departments and organizations.

*There was a total of 13,000 treatments in the hospital dispensaries of the Panama Division which were not reported, and which are consequently not included in the above table.

HOSPITAL DISPENSARIES—*Concluded*

Panama Division				Preston Division				Tela Railroad				Truxillo Railroad				Semi-total				Total
Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.		Emp.		Non-Emp.		
T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	T.	O.	
–	–	–	–	1	96	17	376	110	270	104	192	21	29	18	75	245	1,644	205	1,813	3,907
–	–	–	–	–	1	11	74	–	–	–	1	–	4	1	14	–	14	31	426	471
–	–	–	–	4	45	4	24	89	265	69	118	46	210	20	55	239	1,340	192	457	2,228
–	–	–	–	12	376	37	218	87	278	73	116	36	160	3	40	233	2,832	177	1,354	4,596
–	–	–	–	–	9	–	7	17	54	9	28	40	45	1	4	57	116	10	45	228
–	–	–	–	1	236	–	261	124	846	75	243	5	116	1	39	183	6,363	85	1,081	7,712
–	–	–	–	59	324	14	478	306	724	225	317	138	364	34	84	756	4,107	364	1,680	6,907
–	–	–	–	1	48	3	42	–	8	–	1	4	89	–	12	7	184	5	58	254
–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	1	–	1	2
–	–	–	–	–	–	–	31	–	–	–	–	–	–	–	3	–	–	–	89	89
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	11	2	1	14
–	–	–	–	–	4	–	3	–	166	2	42	1	14	–	7	1	233	2	60	296
–	–	–	–	73	2,147	20	282	96	425	70	140	33	252	4	28	441	8,427	176	1,106	10,150
–	–	–	–	11	591	1	10	–	4	–	–	13	217	2	43	139	2,494	21	173	2,827
–	–	–	–	1	14	4	11	–	–	–	–	2	22	–	3	12	328	17	67	424
–	–	–	–	9	938	5	198	–	–	–	–	16	103	7	6	124	2,968	126	1,777	4,995
–	–	–	–	7	45	2	179	12	34	11	20	166	38	100	59	213	395	289	947	1,844
1,184	*7,070	*521	*4,225	591	9,284	305	8,748	2,587	8,265	1,803	3,509	985	4,850	365	1,330	9,068	95,340	5,362	39,367	149,137

SURGICAL REPORT

	Banes Div.	Colombia Div.	Costa Rica Div.	Guatemala Div.	Jamaica Div.	Panama Div.	Preston Div.	Tela R.R.	Truxillo R.R.	Total	Post Operative Deaths
Bones, Operations On:											
Skull, fracture of	2	–	–	1	–	2	–	8	2	15	3
Craniectomy, decompressive	1	–	–	–	–	–	–	–	–	1	–
Craniectomy, exploratory	–	–	–	–	–	–	–	–	2	2	–
Bone graft	–	–	–	–	–	1	–	1	–	2	–
Fractures, simple	22	6	12	27	14	11	11	18	10	131	–
Fractures, comminuted	–	–	2	1	2	2	2	8	4	21	1
Fractures, compound	5	1	1	8	1	1	5	10	4	36	–
Laminectomy	2	1	–	–	–	–	–	2	–	5	–
Operations for reduction of fractures	–	6	4	4	–	2	–	1	3	20	–
Osteotomy	2	5	–	3	–	1	4	–	1	16	1
Ostectomy	–	–	–	1	–	3	–	3	–	7	–
Resection of elbow	–	–	–	–	–	1	–	–	–	1	–
Resection of knee	–	1	–	–	–	–	–	–	–	1	–
Resection, others	5	3	–	–	–	1	–	1	–	10	1
Others (including unclassified)	1	2	7	1	–	1	1	–	1	14	–
Chest, Operations on:											
Breast abscess, incision of	2	–	–	–	1	–	–	–	4	7	–
Breast, excision of	–	1	–	–	–	1	–	–	–	2	–
Breast and axilla, excision of	1	–	–	–	–	–	–	–	–	1	–
Thoracotomy	–	–	–	–	1	1	4	9	2	17	1
Others (including unclassified)	–	2	–	23	–	2	–	–	8	35	3
Laparotomy:											
Abdomen, penetrating wound of	1	–	–	–	–	–	1	1	–	3	–
Abscess of liver, laparo-hepatotomy	–	1	2	–	–	–	–	–	–	3	–
Abscess of liver, thoraco-hepatotomy	–	5	–	–	–	–	–	10	1	16	–
Appendectomy with local peritonitis	26	22	10	28	2	2	12	10	7	119	2
Appendectomy with general peritonitis	5	2	4	–	–	1	–	1	–	13	2
Cholecystectomy	–	–	1	2	–	–	–	–	1	4	2
Cholecystotomy	–	1	1	–	–	–	–	–	1	3	–
Ectopic gestation	3	–	1	–	–	–	–	3	–	7	–
Entero-enterostomy	–	1	–	–	–	–	–	–	2	3	1
Enterorrhaphy	–	–	–	1	–	–	–	2	1	4	1
Exploratory	–	6	3	3	–	3	5	2	–	22	10

Gastro-enterostomy	1	–	1	1	–	–	–	–	–	3	1
General peritonitis	–	–	–	–	–	–	1	3	–	4	–
Hysterectomy supravaginal	1	21	5	–	–	11	1	3	3	45	4
Pan-hysterectomy	–	–	–	3	–	–	1	1	1	6	1
Hysteropexy	1	2	–	8	–	3	2	2	–	18	–
Hysteropexy with perineorrhaphy	–	4	–	1	–	–	–	1	–	6	–
Intestinal obstruction	4	–	–	–	–	–	2	2	–	8	3
Intussusception, treatment of	–	1	–	–	–	–	–	–	–	1	–
Myomectomy	–	1	–	–	–	1	1	–	–	3	–
Ovarian cystectomy	2	5	2	–	–	–	–	1	–	10	–
Oophorectomy	2	–	–	–	–	–	3	–	1	6	1
Paracentesis abdominalis	36	9	–	–	–	–	–	–	15	60	1
Rupture of spleen	2	–	–	–	–	–	–	–	–	2	–
Salpingectomy	7	5	2	4	–	7	4	5	–	34	1
Salpingo-oophorectomy	2	7	2	7	–	6	3	2	3	32	2
Spleen abscess	–	–	–	1	–	–	–	–	–	1	–
Splenectomy	–	–	–	–	–	3	–	1	–	4	2
Others (including unclassified)	–	3	–	–	–	–	5	–	–	8	1
OBSTETRICAL:											
Abortions	21	1	1	3	–	9	8	10	4	57	1
Births, premature	3	1	1	–	–	5	4	3	3	20	–
Births, normal	21	33	29	18	–	44	36	63	37	281	1
Births, multiple	–	1	–	–	–	1	–	2	1	5	–
Births, forceps operations	4	3	2	1	–	3	–	1	1	15	–
Births, abnormal presentations	2	1	–	1	–	–	2	–	–	6	1
Births, versions	3	1	2	–	–	–	–	1	1	8	3
Births, episiotomy	–	2	–	–	–	–	–	6	3	11	–
Births, Caesarian operations	–	2	3	–	–	–	–	2	–	7	2
Repairs of Perineum	1	1	–	–	–	–	2	1	1	6	–
Others (including unclassified)	–	1	3	–	–	5	3	4	3	19	3
GENITO-URINARY TRACT:											
Chancroid operations	2	6	661	–	–	–	1	104	1	775	–
Circumcisions	9	14	15	15	–	36	16	23	4	132	–
Curettage uteri	11	40	13	9	–	–	4	10	1	88	–
Cystotomy	–	1	1	–	–	1	–	–	3	6	2
Epididymectomy	–	–	5	–	–	–	–	–	1	6	–
Epididymotomy	–	–	–	–	–	–	–	5	1	6	–
Hydrocele, single, radical cure	7	3	12	2	7	6	8	8	3	56	–
Hydrocele, double, radical cure	2	1	4	–	–	–	1	–	–	8	–

SURGICAL REPORT—*Continued*

	Banes Div.	Colombia Div.	Costa Rica Div.	Guatemala Div.	Jamaica Div.	Panama Div.	Preston Div.	Tela R.R.	Truxillo R.R.	Total	Deaths
Nephrectomy	1	–	–	–	–	–	–	–	–	1	–
Nephrotomy	1	–	1	–	–	–	–	1	–	3	–
Orchidectomy	1	1	3	1	–	3	1	1	–	11	–
Penis, operations on	4	3	13	1	–	1	5	17	11	55	–
Perineorrhaphy	2	8	2	3	–	–	–	1	–	16	–
Perinephritic abscess	1	–	–	–	–	–	–	–	–	1	–
Prostatectomy	–	–	1	–	–	–	–	–	1	2	–
Scrotum operations	1	5	2	3	–	1	3	1	–	16	–
Trachelorrhaphy	1	–	–	2	–	–	1	–	–	4	–
Vaginal puncture for pelvic cellulitis	–	4	–	–	–	–	–	1	–	5	–
Vaginal operations	3	2	–	2	–	10	–	1	2	20	–
Varicocele, radical cure	–	2	–	1	–	–	1	–	–	4	–
Urethrotomy, internal	3	–	14	1	–	–	–	3	2	23	–
Urethrotomy, external	5	3	1	2	–	3	–	2	–	16	4
Others (including unclassified)	–	13	72	3	–	–	–	3	3	94	–
HERNIOTOMY:											
Femoral	–	1	1	1	–	–	–	–	–	3	–
Inguinal, single	12	49	11	6	–	22	13	27	12	152	1
Inguinal, double	2	5	1	–	–	2	2	1	2	15	–
Strangulated	5	3	3	–	–	2	–	1	–	14	2
Umbilical	1	–	–	1	–	–	–	–	–	2	–
Ventral	1	7	1	1	–	–	2	–	–	12	–
ADENECTOMY:											
Axillary	2	–	1	–	–	–	–	13	1	17	–
Cervical	1	1	1	3	–	–	–	2	–	8	–
Femoral	–	4	1	–	–	–	–	35	2	42	–
Inguinal, single	15	65	228	24	1	13	5	51	10	412	1
Inguinal, double	1	10	9	–	–	2	–	3	2	27	–
AMPUTATIONS:											
Hand	–	1	–	–	–	–	–	1	–	2	–
Forearm	1	1	–	–	–	3	1	1	–	7	–
Arm	–	1	1	–	–	–	–	2	–	4	1
Thigh	–	–	4	–	–	–	–	–	1	5	–
Leg	1	2	2	–	–	4	2	1	2	14	3
Foot	–	1	1	–	–	3	2	–	–	7	–
Digits, multiple	15	13	15	12	1	11	13	16	3	99	–
Others (including unclassified)	–	–	–	1	–	–	–	–	–	1	1

JOINTS, OPERATIONS ON:											
Arthrotomy	2	1	–	9	–	–	1	3	4	20	2
Reduction of dislocation	17	–	–	7	1	2	1	4	2	34	–
Others (including unclassified)	–	1	10	1	–	1	1	–	–	14	–
MUSCLES AND TENDONS, OPERATIONS ON:											
Tenorrhaphy	4	–	8	–	–	3	3	2	–	20	1
Others (including unclassified)	–	1	–	4	–	–	–	–	1	6	–
RECTUM, OPERATIONS ON:											
Fistula in ano	1	3	5	–	–	1	–	1	–	11	–
Hemorrhoids	4	17	5	8	4	17	2	4	2	63	–
Ischio-rectal abscess	1	4	3	–	–	–	–	–	2	10	1
Prolapsus recti	1	–	–	–	–	–	–	–	1	2	–
Others (including unclassified)	–	1	–	1	–	–	–	1	1	4	–
MISCELLANEOUS:											
Abscesses, treatment of	314	522	549	372	68	122	290	230	209	2,676	4
Aneurism, operation for	–	1	–	–	–	–	–	–	–	1	–
Blood transfusions	–	1	–	–	–	–	–	1	1	3	–
Carbuncles, treatment of	82	48	186	11	–	5	13	52	3	400	1
Cysts	8	17	21	2	3	11	4	–	3	69	–
Elephantiasis, treatment of	–	–	8	–	–	–	–	–	–	8	–
Fistulous tracks	1	3	1	–	–	1	–	–	1	7	–
Nails, extirpation of	12	4	4	6	9	4	2	–	4	45	–
Neoplasm, excision of, Benign	3	2	–	–	–	1	6	5	2	19	1
Neoplasm, excision of, Malignant	–	–	–	2	–	17	–	4	–	23	–
Plastic operations for severe injuries	–	1	–	–	–	3	–	1	3	8	–
Plastic operations for effects of disease	–	–	–	9	–	4	–	–	–	13	–
Plastic operations for congenital defects	10	–	–	–	–	–	–	–	–	10	–
Removal of foreign body	–	2	5	23	3	10	3	–	5	51	–
Skin graft	–	1	1	1	–	1	2	1	17	24	–
Snake bite, treatment of	–	–	4	1	–	–	–	1	1	7	–
Thyroidectomy	–	–	1	–	–	–	1	–	2	4	–
Ulcers, treatment of	88	25	1,747	387	–	–	232	173	–	2,652	–
Varicose veins, treatment of	–	3	–	1	–	–	–	–	2	6	–
Wounds, gunshot	6	3	–	13	–	5	6	62	3	98	1
Wounds, scalds and burns	61	11	56	–	4	–	31	15	5	183	–
Wounds, stab	123	16	–	3	1	1	1	89	1	235	2
Wounds, others	906	8	2,238	264	14	66	1,477	60	20	5,053	–
Various other minor operations	19	31	218	14	85	156	26	106	19	674	3
Various other major operations	–	8	5	–	–	–	–	2	–	15	–
Others (including unclassified)	–	–	–	–	–	–	–	–	–	–	–

SURGICAL REPORT—*Concluded*

	Banes Div.	Colombia Div.	Costa Rica Div.	Guatemala Div.	Jamaica Div.	Panama Div.	Preston Div.	Tela R.R.	Truxillo R.R.	Total	Post Operative Deaths
EAR, OPERATIONS ON:											
Abscess, incision of	2	56	–	–	1	–	–	7	–	66	–
Mastoid operations	–	1	1	2	–	–	1	1	1	7	1
Paracentesis of membrane tympani	9	–	–	–	–	–	1	–	5	15	–
Removal of foreign bodies	–	2	44	80	4	–	1	91	–	222	–
Others (including unclassified)	–	–	19	–	–	–	–	1	–	20	–
EYE, OPERATIONS ON:											
Abscess, incision of	1	–	–	–	1	1	1	3	–	7	–
Cataract, extraction of	–	–	–	–	–	2	–	–	–	2	–
Chalazion, excision of	–	–	–	–	–	–	–	–	2	2	–
Enucleation	1	3	–	1	–	3	–	4	1	13	–
Hordeolum	–	–	1	–	2	–	–	–	–	3	–
Lid operations	1	1	–	–	–	–	–	–	–	2	–
Pterygium, excision of	1	10	–	–	–	–	–	–	–	11	–
Pterygium, transplantation of	–	1	–	–	–	4	–	–	–	5	–
Removal of foreign body	49	19	81	10	3	9	150	25	1	347	–
Trachoma, treatment of	2	–	–	–	–	–	3	–	–	5	–
Others (including unclassified)	–	–	2	–	–	1	–	–	1	4	–
NOSE AND THROAT, OPERATIONS ON:											
Adeno-tonsillectomy	1	–	7	10	–	–	14	19	1	52	–
Peritonsillar abscess, incision of	–	–	4	1	1	–	–	–	1	7	–
Removal of polypi	–	3	–	–	–	–	2	–	1	6	–
Tonsillectomy	4	16	5	–	–	23	10	3	2	63	–
Tracheotomy	–	–	–	–	–	–	–	1	–	1	–
Others (including unclassified)	2	–	1	2	–	–	–	–	1	6	–
TOTAL	2,038	1,288	6,441	1,490	234	731	2,489	1,511	530	16,752	88
Injections, intravenous	437	2,551	1,782	611	6	2,087	964	1,464	562	10,464	–
Tooth extraction	221	370	495	213	15	123	206	29	136	1,808	–
Vaccinations	8,406	–	139	–	1,185	109	42	1,012	3,513	14,406	–
GRAND TOTAL	11,102	4,209	8,857	2,314	1,440	3,050	3,701	4,016	4,741	43,430	88

CONSOLIDATED

	Banes Division				Colombia Division				Costa Rica Division				Guatemala Division			
	Hosp.		Hosp. Disp.		Hosp.		Hosp. Disp.		Hosp.		Hosp. Disp.		Hosp.		Hosp. Disp.	
	Total	Pos.	Total	Pos.	Total	Pos.	Total	Pos.	Total	Pos.	Total	Pos.	Total	Pos.	Total	Pos.
BLOOD EXAMINATIONS:																
Total examinations	4109	–	1581	–	4729	–	800	–	6513	–	485	–	4317	–	275	–
Leucocyte enumerations	202	–	37	–	250	–	30	–	124	–	50	–	87	–	3	–
Differential leucocyte counts	1	–	1	–	106	–	13	–	60	–	28	–	40	–	1	–
Erythrocyte enumerations	6	–	1	–	5	–	31	–	54	–	31	–	3	–	–	–
Hemoglobin estimations	1194	–	–	–	3780	–	469	–	3580	–	168	–	41	–	13	–
Malaria	–	2130	–	497	–	–	–	–	458	–	25	–	–	–	–	–
(a) Estivo-autumnal	–	153	–	57	–	384	–	39	–	721	–	70	–	1628	–	31
(b) Tertian	–	74	–	14	–	196	–	43	–	598	–	41	–	722	–	26
(c) Quartan	–	6	–	9	–	23	–	–	–	12	–	5	–	21	–	–
(d) Mixed infection	–	6	–	2	–	9	–	1	–	12	–	5	–	91	–	2
Widal tests	–	465	–	15	234	68	74	30	8	67	2	23	–	2	–	–
Other examinations	–	7	–	–	138	8	9	1	4	35	–	15	–	–	–	–
Blood Thick Film for Malaria	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
URINE EXAMINATIONS:																
Total examinations	3714	–	543	–	4510	–	689	–	4196	–	460	–	4521	–	135	–
Albumin	–	578	–	78	–	1987	–	193	–	1275	156	170	–	851	–	21
Casts	–	252	–	20	–	1097	–	83	–	120	–	32	–	449	–	7
Pus	–	169	–	41	–	981	–	157	–	746	–	128	–	523	–	17
Blood	–	41	–	8	–	677	–	129	–	49	–	13	–	85	–	5
Sugar	–	13	–	13	3139	16	481	15	–	16	–	39	–	–	–	1
Hemoglobin	–	3	–	–	2	2	–	–	–	29	–	3	–	38	–	–
Gonococci	–	1	–	–	13	13	1	–	–	8	–	12	–	2	–	1
B. tuberculosis	–	–	–	2	10	–	–	–	–	–	–	–	–	–	–	–
Other examinations	–	249	–	21	258	256	171	41	5	49	3	18	–	28	–	–
SPUTUM EXAMINATIONS:																
Total examinations	75	–	26	–	523	–	141	–	168	–	74	–	290	–	20	–
B. tuberculosis	–	7	–	1	–	58	–	28	–	27	–	16	–	32	–	3
Pus	–	4	–	1	–	396	–	73	–	53	–	15	–	3	–	1
Blood	–	1	–	2	–	117	–	18	–	31	–	11	–	7	–	–
Other examinations	–	22	–	3	37	29	2	2	3	18	–	13	–	–	–	–
STOOL EXAMINATIONS:																
Total examinations	3210	–	488	–	4493	–	534	–	4945	–	892	–	4362	–	64	–
Uncinaria	–	380	–	52	–	3291	–	100	–	2256	–	333	–	2044	–	16
Trichuris	–	591	–	167	–	1967	–	133	–	462	–	118	–	1806	–	20
Ascaris	–	764	–	56	–	1055	–	45	–	155	–	55	–	1722	–	16
Oxyuris vermicularis	–	6	–	1	–	8	–	–	–	7	–	3	–	1	–	–
Strongyloides stercoralis	–	36	–	10	–	208	–	18	–	30	–	10	–	75	–	1
Taenia saginata	–	1	–	1	–	10	–	2	–	–	–	–	–	9	–	–
Taenia solium	–	–	–	–	–	1	–	–	–	–	–	1	–	–	–	–
Other tape-worms	–	–	–	–	–	8	–	2	–	9	–	1	–	–	–	–
Entameba histolytica	–	21	–	–	–	779	–	156	–	57	–	31	–	70	–	1
Other entamebae	–	–	–	–	–	480	–	63	–	57	–	25	–	69	–	–
Balantidium coli	–	2	–	4	–	36	–	3	–	8	–	11	–	148	–	1
Flagellates, intestinal	–	–	–	–	–	996	–	134	–	88	–	42	–	132	–	1
Blood	–	31	–	6	–	356	–	49	–	65	–	25	–	260	–	8
Pus	–	25	–	2	–	452	–	61	–	51	–	18	–	284	–	6
Other examinations	–	2	–	1	11	6	–	–	2	64	1	25	–	88	–	–
Bilharzia	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–
MISCELLANEOUS SMEARS:																
Total examinations	13	–	22	–	165	–	147	–	244	–	59	–	–	–	–	–
Eye	–	–	–	–	48	13	5	4	5	16	1	4	23	15	4	2
Throat	–	–	–	–	20	6	9	3	2	5	–	4	1	1	1	1
Gums and mouth	–	1	–	2	2	1	–	–	–	–	–	–	–	–	–	–
Nose	–	2	–	1	16	4	15	1	2	3	1	1	1	–	1	1
Ear	–	2	–	7	–	–	–	–	3	4	2	3	2	2	–	–
Genital source (Gonococcus)	–	3	–	–	98	25	106	31	12	38	12	22	38	17	12	7
Cutaneous ulcer	–	–	–	–	16	4	1	–	20	24	8	10	3	3	1	–
Other smears	–	–	–	–	63	19	14	2	42	62	4	14	15	11	–	–
Lepro-bacillus	–	–	–	–	–	–	–	–	–	–	–	–	1	1	–	–

LABORATORY REPORT

Jamaica Division				Panama Division				Preston Division				Tela Railroad				Truxillo Railroad			
Hosp.		Hosp. Disp.		Hosp.		Hosp. Disp.		Hosp.		Hosp. Disp.		Hosp.		Hosp. Disp.		Hosp.		Hosp. Disp.	
Total	Pos.	Total	Pos.	Total	Pos.	Total	Pos.	Total	Pos.	Total	Pos.	Total	Pos.	Total	Pos.	Total	Pos.	Total	Pos.
–	–	–	–	5686	–	3463	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	117	–	30	–	167	–	11	–	299	–	–	–	157	–	10	–
–	–	–	–	82	–	23	–	59	–	4	–	36	–	–	–	160	–	11	–
–	–	–	–	23	–	6	–	3	–	2	–	–	–	–	–	84	–	7	–
5	–	21	–	2736	–	1166	–	1604	–	2	–	218	–	–	–	156	–	16	–
9	–	39	–	–	–	–	–	3113	–	660	–	5930	–	–	–	2922	–	607	–
–	3	–	–	–	96	–	32	–	1161	–	123	–	1678	–	–	–	796	–	106
–	6	–	24	–	696	–	621	–	81	–	20	–	299	–	–	–	177	–	33
–	–	–	–	–	–	–	1	–	56	–	4	–	55	–	–	–	56	–	4
–	–	–	–	–	23	–	1	–	12	–	2	–	41	–	–	–	22	–	2
–	–	–	–	–	–	–	–	9	6	–	–	94	21	–	–	2	–	–	–
–	–	–	–	–	–	–	–	–	128	–	9	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	1355	287	–	–	–	–	–	–
–	–	–	–	3641	–	955	–	2804	–	487	–	4313	–	–	–	3317	–	394	–
10	2	168	38	–	1114	–	90	–	598	–	74	–	813	–	–	–	1153	–	72
2	2	11	8	–	597	–	150	–	189	–	40	–	1026	–	–	–	365	–	25
2	2	8	8	–	3235	–	655	–	507	–	208	–	990	–	–	–	1214	–	193
–	–	5	4	–	193	–	27	–	142	–	38	–	419	–	–	–	193	–	24
8	–	139	9	–	1	–	–	–	19	–	6	–	20	–	–	–	–	–	–
1	1	–	–	–	2	–	–	–	10	–	–	–	7	–	–	–	15	–	2
–	–	1	–	–	–	–	–	–	–	–	–	–	16	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
4	4	93	39	–	68	–	10	7	6	–	–	–	9	–	–	44	44	2	2
–	–	–	–	329	–	17	–	138	–	37	–	396	–	–	–	262	–	16	–
5	1	10	3	–	4	–	1	–	24	–	1	–	75	–	–	–	60	–	1
2	5	5	5	–	4	–	1	–	–	–	–	–	–	–	–	–	–	–	–
2	2	–	–	–	6	–	–	–	2	–	–	–	–	–	–	–	–	–	–
–	–	1	1	–	6	–	–	–	19	–	2	–	–	–	–	–	–	–	–
–	–	–	–	3110	–	392	–	1994	–	82	–	3984	–	–	–	3053	–	112	–
–	–	13	4	–	1147	–	158	–	252	–	7	–	1602	–	–	–	1466	–	29
–	–	1	1	–	1244	–	215	–	218	–	13	–	1987	–	–	–	1039	–	40
–	–	1	1	–	214	–	51	–	519	–	9	–	1403	–	–	–	493	–	19
–	–	–	–	–	–	–	–	–	–	–	1	–	5	–	–	–	1	–	–
–	–	–	–	–	1	–	1	–	133	–	3	–	202	–	–	–	–	–	–
–	–	–	–	–	1	–	–	–	1	–	–	–	24	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	10	–	–	–	–	–	–
–	–	1	–	–	17	–	–	–	23	–	–	–	356	–	–	–	36	–	1
–	–	–	–	–	–	–	–	–	12	–	1	–	754	–	–	–	3	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	12	–	–	–	5	–	–
–	–	–	–	–	–	–	–	–	146	–	5	–	433	–	–	23	26	–	–
1	–	5	–	–	10	–	3	–	40	–	1	–	281	–	–	–	172	–	–
–	–	–	–	–	15	–	4	–	35	–	2	–	211	–	–	–	201	–	1
–	–	2	–	–	–	–	–	–	8	–	–	–	466	–	–	1	1	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	78	–	49	3	11	–	23	–	–	–	–	–	28	–	9	–
–	–	–	–	–	–	–	–	–	1	–	–	15	13	–	–	2	2	2	1
–	–	–	–	–	–	–	–	6	5	–	–	11	3	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	10	9	–	–	4	4	2	2
–	–	–	–	–	–	–	–	2	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	4	2	–	–
2	2	1	1	–	53	–	20	20	17	27	21	154	57	–	–	39	25	50	21
–	–	–	–	–	–	–	–	1	1	–	–	–	–	–	–	10	2	–	–
–	–	–	–	4	3	–	1	4	–	–	–	–	–	–	–	168	111	1	1
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–

CONSOLIDATED

	Banes Division				Colombia Division				Costa Rica Division				Guatemala Division			
	Hosp.		Hosp. Disp.		Hosp.		Hosp. Disp.		Hosp.		Hosp. Disp.		Hosp.		Hosp. Disp.	
	Total	Pos.	Total	Pos.	Total	Pos.	Total	Pos.	Total	Pos.	Total	Pos.	Total	Pos.	Total	Pos.
EXAMINATION FOR SYPHILIS:																
Total examinations	134	–	103	–	4505	–	977	–	416	–	96	–	–	–	–	–
Complement Fix. Test (blood)	–	10	–	5	2611	1013	573	178	584	579	236	170	–	–	–	–
Flocculation test (blood)	–	60	–	45	1920	653	396	131	131	145	68	59	366	145	63	24
Dark field examination	–	–	–	–	11	2	5	1	1	–	–	–	3	2	4	1
Spinal fluid test	–	–	–	–	19	2	4	2	–	2	–	–	–	–	–	–
Dark field for spir. yaws	–	–	–	–	6	3	–	–	–	–	–	–	–	–	–	–
Chancre	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
CULTURES:																
Total examinations	–	–	–	–	1184	–	86	–	169	–	64	–	–	–	–	–
Blood	–	–	–	–	233	41	33	8	24	15	5	6	13	6	–	–
Urine	–	–	–	–	112	36	5	1	19	30	1	9	–	–	–	–
Sputum	–	–	–	–	35	17	–	–	13	12	–	1	–	–	–	–
Stool	–	–	–	–	928	79	24	5	40	56	12	17	–	–	–	–
Fluid from joint	–	–	–	–	10	1	–	–	–	–	–	–	–	–	–	–
Spinal fluid	–	–	–	–	10	2	–	–	1	1	–	–	2	2	–	–
Pleural fluid	–	3	–	–	3	–	–	–	2	7	–	–	1	–	–	–
Throat	–	–	–	–	33	7	21	4	2	7	–	1	–	–	–	–
Other sources	–	–	–	–	39	7	8	1	10	26	7	14	–	–	1	1
Autopsy sources	–	–	–	–	–	–	–	–	–	–	–	–	1	–	1	1
Others	–	–	–	–	8	2	–	–	–	–	–	–	–	–	–	–
MISCELLANEOUS:																
Total examinations	68	–	–	–	141	6	30	–	–	–	–	–	–	–	–	–
Autopsies performed	9	–	–	–	2	–	–	–	4	–	–	–	9	–	5	–
Surgical tissues reported	–	–	–	–	3	–	–	–	–	–	–	–	1	1	1	1
Number of X-ray examinations	133	–	4	–	619	–	20	–	376	–	–	–	306	238	73	58
Small-pox vaccinations	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1800	–
Others	–	–	–	–	11	–	–	–	–	–	–	–	–	–	–	–
Reports of progress on special problems	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–

LABORATORY REPORT—*Concluded*

Jamaica Division				Panama Division				Preston Division				Tela Railroad				Truxillo Railroad			
Hosp.		Hosp. Disp.		Hosp.		Hosp. Disp.		Hosp.		Hosp. Disp.		Hosp.		Hosp. Disp.		Hosp.		Hosp. Disp.	
Total	Pos.	Total	Pos.	Total	Pos.	Total	Pos.	Total	Pos.	Total	Pos.	Total	Pos.	Total	Pos.	Total	Pos.	Total	Pos.
–	–	–	–	1493	–	293	–	16	–	5	–	–	–	–	–	–	–	–	–
–	–	–	–	–	298	–	69	–	–	–	–	510	88	–	–	37	12	–	–
–	–	–	–	–	284	–	48	373	211	62	14	–	–	–	–	420	86	239	64
–	–	–	–	2	3	–	1	18	3	–	–	29	10	–	–	3	1	4	–
–	–	–	–	2	–	–	–	1	–	–	–	2	1	–	–	7	4	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2	1	–	–
–	–	–	–	2	–	–	–	25	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	1	1	–	–	15	7	–	–	82	19	–	–	16	2	–	–
–	–	–	–	–	–	–	–	–	–	–	–	21	17	–	–	16	15	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	2	–	–	–	6	6	–	–	13	4	–	–	4	–	–	–
–	–	–	–	1	1	–	–	–	–	–	–	2	–	–	–	5	2	–	–
–	–	–	–	–	–	–	–	1	–	–	–	3	–	–	–	7	2	–	–
–	–	–	–	–	–	–	–	1	1	–	–	1	1	–	–	6	2	–	–
–	–	–	–	–	–	–	–	–	–	–	–	10	6	–	–	–	–	–	–
–	–	–	–	–	–	–	–	8	8	–	–	9	7	–	–	5	4	–	–
–	–	–	–	–	–	–	–	–	–	–	–	1	1	–	–	5	2	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	37	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	53	–	–	–	26	4	9	–	23	–	–	–	72	–	–	–
–	–	–	–	–	–	–	–	3	–	–	–	28	28	–	–	1	–	–	–
–	–	–	–	–	–	–	–	391	–	12	–	982	–	–	–	282	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	8	8	1	–	–	–	–	–	2180	517	–	–	18	8	–	–
–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–

NUMBER AND CLASSIFICATION OF X-RAY EXAMINATIONS

	Banes Division	Colombia Division	Costa Rica Division	Guatemala Division	Jamaica Division	Panama Division	Preston Division	Tela Railroad	Truxillo Railroad	Total
Nature of Examination:										
Vertebral column	3	25	15	2	–	–	13	7	7	72
Skull	5	25	23	8	–	4	13	31	15	124
Sternum	–	1	19	–	–	1	1	–	–	22
Ribs	1	6	29	11	–	4	10	9	15	85
Hyoid bone	–	–	15	–	–	–	–	–	–	15
Upper limbs	34	66	60	96	–	45	93	62	67	523
Lower limbs	33	87	104	73	–	58	99	74	56	584
Neck	–	–	8	–	–	1	1	–	–	10
Teeth	8	31	47	–	–	11	12	–	8	117
Heart	10	29	7	2	–	–	9	336	5	398
Lungs	36	253	7	87	–	7	113	419	96	1,018
Liver	1	14	10	–	–	–	–	2	2	29
Spleen	–	–	–	2	–	–	–	–	–	2
Kidneys	–	27	2	–	–	–	5	9	6	49
Gastro-intestinal tract	4	34	16	5	–	2	17	15	5	98
Pelvic organs	1	14	14	10	–	4	3	3	–	49
Miscellaneous	1	27	–	–	–	–	14	15	–	57
Total	137	639	376	296	–	137	403	982	282	3,252

METEOROLOGICAL REPORT

AVERAGE TOTAL RAINFALL (INCHES)

MONTH:	Banes Division	Colombia Division	Costa Rica Division	Guatemala Division	Jamaica Division	Panama Division	Preston Division	Tela Railroad	Truxillo Railroad	Average for All Divisions
January	2.94	.10	6.09	4.18	3.19	4.66	1.93	7.01	6.40	–
February	3.97	.09	5.00	5.13	6.17	2.56	2.86	4.75	4.46	–
March	1.27	–	2.28	3.75	2.71	1.85	1.45	4.11	2.82	–
April	3.97	.01	2.62	3.65	1.83	1.65	5.96	1.65	.59	–
May	6.50	3.14	6.81	4.16	3.23	4.34	9.57	1.82	2.64	–
June	3.02	7.50	10.02	6.56	2.29	5.50	4.16	1.82	4.47	–
July	2.49	4.63	11.92	9.55	3.53	10.60	2.45	7.60	3.35	–
August	3.15	5.48	6.32	12.94	9.11	4.62	2.64	7.24	6.86	–
September	6.82	9.86	6.49	10.02	7.56	5.49	4.14	6.69	5.06	–
October	6.78	12.48	7.82	15.31	7.07	7.44	7.91	8.76	12.22	–
November	5.58	7.20	17.77	6.90	6.29	17.94	5.68	19.57	27.20	–
December	7.79	.74	14.65	5.88	3.96	13.38	7.01	8.65	11.15	–
TOTALS	54.28	51.23	97.79	88.03	56.94	80.03	55.76	79.67	87.22	72.33

MEAN TEMPERATURE (FAHRENHEIT)

	Banes Division	Colombia Division	Costa Rica Division	Guatemala Division	Jamaica Division	Panama Division	Preston Division	Tela Railroad	Truxillo Railroad	Average for All Divisions
January	68.60	80.00	73.50	74.00	72.00	77.50	69.00	74.50	77.50	–
February	69.65	81.50	73.50	76.50	73.00	78.50	68.00	73.75	77.00	–
March	72.35	81.50	75.00	80.50	72.00	79.50	73.00	77.50	78.00	–
April	79.50	83.50	76.00	84.00	75.50	80.50	76.00	80.40	82.00	–
May	77.00	83.00	76.50	85.50	76.50	80.50	78.00	80.75	81.50	–
June	77.50	82.00	76.00	84.00	77.00	80.00	79.00	81.85	82.00	–
July	80.15	81.00	75.00	81.00	77.00	83.00	78.00	82.25	81.50	–
August	79.50	82.00	75.50	79.00	77.00	79.50	78.00	83.50	82.00	–
September*	79.65	80.00	76.00	80.50	75.00	80.50	79.00	84.25	81.50	–
October	79.00	81.00	75.50	78.00	77.00	80.50	78.50	84.25	80.50	–
November	78.35	81.00	73.50	69.50	76.00	79.50	74.50	77.25	77.50	–
December	72.85	81.00	74.00	77.50	73.00	79.00	71.00	78.00	78.50	–
Average maximum temperature	91.87	92.92	86.17	95.75	87.75	89.00	92.08	90.33	87.83	–
Average minimum temperature	60.48	70.00	63.83	62.58	62.42	70.75	58.25	69.38	72.08	–
Average mean temperature	76.18	81.46	75.00	79.17	75.09	79.88	75.17	79.86	79.96	–

GENERAL STATEMENT PASSENGER SERVICE

NEW YORK PASSENGER STEAMSHIPS

	Calamares	Carrillo	Metapan	Pastores	Santa Marta	Sixaola	Tivives	Toloa	Ulua	Zacapa	Grand Total
Number of voyages made	13	13	13	13	13	13	13	13	13	13	130
Total number of officers, all voyages	287	249	247	288	244	247	247	289	299	247	2,644
Total number in crews, all voyages	1,325	885	880	1,346	886	878	883	1,370	1,343	878	10,674
Total number of ships' laborers, all voyages	177	205	175	175	209	195	227	156	165	150	1,834
Number of seamen given physical examination before "signing-on"	1,317	886	884	1,325	893	885	884	1,374	1,335	877	10,660
Number of rejected applicants, "signing-on" day	4	5	–	1	7	–	3	18	6	–	44
Number of persons rejected at tropical ports	–	–	–	1	–	–	–	–	–	1	2
Number of cabin passengers carried	3,032	2,833	1,566	3,304	2,762	2,866	2,682	3,224	3,114	1,638	27,021
Number of deck passengers carried	330	1,198	542	310	1,022	1,018	1,199	330	294	437	6,680
OFFICERS, CREWS, AND SHIPS' LABORERS:											
Total number of patients treated	565	313	171	200	555	319	237	427	437	388	3,612
Total number of treatments in office	1,000	509	338	436	836	515	385	768	648	611	6,046
Total number of treatments in quarters	64	58	47	95	67	52	154	232	61	50	880
PASSENGERS:											
Total number of patients treated	203	158	70	52	253	138	105	117	154	99	1,349
Total number of treatments in office	191	146	91	79	268	151	64	136	150	104	1,380
Total number of treatments in staterooms	154	95	55	89	57	55	131	140	144	51	971
Number of vaccinations	17	341	211	1	53	350	121	14	22	342	1,472
Number of persons detained by quarantine and immigration authorities	6	6	13	–	2	3	5	14	6	13	68
*Number of deaths	1	1	–	1	1	–	1	–	1	1	7

*The deaths aboard steamships of the New York Division were caused by: drowning, 2; heart failure, 1; chronic myocarditis, 1; angina pectoris, 1; cerebral embolism, 1; carcinoma of intestines and stomach, 1.

NEW ORLEANS PASSENGER STEAMSHIPS

	Abangarez	Atenas	Cartago	Coppename	Heredia	Parismina	Saramacca	Suriname	Turrialba	Grand Total
Number of voyages made	17	18	17	26	17	18	26	26	17	182
Total number of officers, all voyages	340	359	346	486	344	363	485	493	335	3,551
Total number in crews, all voyages	1,019	1,074	1,029	970	1,030	1,078	1,066	1,062	1,017	9,345
Total number of ships' laborers, all voyages	125	108	567	267	505	584	166	208	90	2,620
Number of seamen given physical examination before "signing-on"	1,027	1,086	1,042	991	1,040	1,094	1,086	1,078	1,027	9,471
Number of rejected applicants, "signing-on" day	9	9	9	13	8	10	16	15	4	93
Number of persons rejected at tropical ports	–	–	–	–	–	–	–	–	–	–
Number of cabin passengers carried	2,427	2,362	2,590	679	2,438	2,706	1,467	1,005	2,338	18,006
Number of deck passengers carried	274	297	598	63	610	662	89	14	316	2,923
OFFICERS, CREW AND SHIPS' LABORERS:										
Total number of patients treated	685	471	210	457	477	501	402	601	546	4,350
Total number of treatments in office	972	601	388	234	595	796	548	841	729	5,704
Total number of treatments in quarters	65	63	78	36	24	85	73	135	86	645
PASSENGERS:										
Total number of patients treated	155	96	52	34	70	111	55	79	207	859
Total number of treatments in office	229	117	66	36	85	174	72	78	240	1,097
Total number of treatments in staterooms	197	49	32	15	23	105	23	63	84	591
Number of vaccinations	291	214	395	103	28	10	278	181	179	1,679
Number of persons detained by quarantine and immigration authorities	9	6	61	1	3	18	12	16	11	137
*Number of deaths	–	–	–	1	1	–	–	–	1	3

*The deaths aboard steamships of the New Orleans Division were caused by: acute nephritis, 1; fractured skull, 1; undetermined, 1.

CLASSIFICATION OF DISEASES TREATED ABOARD PASSENGER STEAMSHIPS AND BY PORT MEDICAL OFFICERS AT NEW YORK, NEW ORLEANS AND BOSTON

	Steamships N. Y. Division		Steamships N. O. Division		Port Med. Officer New York		Port Med. Officer New Orleans		Port Med. Officer Boston		Revere Sugar Refinery Boston	
	Crew	Pass.	Crew	Pass.	Emp.	Non-Emp.	Emp.	Non-Emp.	Emp.	Non-Emp.	Emp.	Non-Emp.
Endemic or infectious diseases (Charts Nos. 1 to 42, incl.)	165	47	112	26	43	–	10	–	23	–	–	–
General diseases not included above (Charts Nos. 43 to 69 f., incl.)	110	35	32	17	9	–	3	1	8	–	–	–
Diseases of the nervous system and organs of special sense (Charts Nos. 70 to 86, incl.)	213	109	163	57	58	–	38	2	36	–	–	–
Diseases of the circulatory system (Charts Nos. 87 to 96, incl.)	72	53	14	8	3	–	10	1	7	–	–	–
Diseases of the respiratory system (Charts Nos. 97 to 107, incl.)	362	109	490	102	33	–	92	12	21	–	–	–
Diseases of the digestive system (Charts Nos. 108 to 127, incl.)	814	364	2,024	290	74	2	105	9	33	–	–	–
Non-venereal diseases of the genito-urinary system and its adnexa (Charts Nos. 128 to 142, incl.)	38	23	30	15	12	–	5	–	2	–	–	–
The puerperal state (Charts No. 143 to 150, incl.)	–	2	–	3	–	–	–	–	–	–	–	–
Diseases of the skin or cellular tissue (Charts Nos. 151 to 154, incl.)	177	46	334	79	50	–	71	2	74	–	–	–
Diseases of the bones and organs of locomotion (Charts Nos. 155 to 158, incl.)	222	61	31	3	18	–	2	–	19	–	–	–
Malformations (Chart No. 159)	–	–	–	–	–	–	–	–	–	–	–	–
Diseases of early infancy (Charts Nos. 160 to 163, incl.)	–	–	–	–	–	–	–	–	–	–	–	–
Old age (Chart No. 164)	–	–	–	–	–	–	–	–	–	–	–	–
External causes (Charts Nos. 165 to 203, incl.)	1,301	205	662	67	762	6	426	9	369	–	2,479	–
Ill-defined diseases (Charts Nos. 204 to 205, incl.)	138	295	458	192	20	–	138	1	–	–	–	–
TOTAL	3,612	1,349	4,350	859	1,082	8	900	37	592	–	2,479	–

NOTE: This table gives only cases treated on our steamships, and does not show the number of treatments.

There were no cases of quarantinable diseases aboard our steamships during the year. There were no cases of trachoma; and 2 cases of venereal diseases among the passengers, and 89 cases among members of the crews.

The chart numbers used are taken from the "International List of Causes of Sickness and Death." These chart numbers are used universally by public-health and city and state health departments and organizations.

REPORT OF PORT MEDICAL OFFICERS AND SANITARY INSPECTOR

MEDICAL AND SURGICAL CASES TREATED

Port	Medical Cases			Surgical Cases			Total	
	No. of Cases Emp.	No. of Cases Non-Emp.	No. of Treatments	No. of Cases Emp.	No. of Cases Non-Emp.	No. of Treatments	No. of Cases	No. of Treatments
New York	163	2	236	919	6	2,362	1,090	2,598
New Orleans	398	24	497	502	13	1,741	937	2,238
Boston Long Wharf	223	–	301	369	–	711	592	1,012
Boston Revere Refinery	–	–	–	2,479	–	3,900	2,479	3,900
GRAND TOTAL	784	26	1,034	4,269	19	8,714	5,098	9,748

PHYSICAL EXAMINATION OF PROSPECTIVE EMPLOYEES

Port	Total No. Examined	Total No. Rejected	Per Cent Rejected
New York	710	88	12.39
New Orleans	448	46	10.27
Boston	361	7	1.94
TOTAL	1,519	141	9.28

PHYSICAL EXAMINATION OF MEMBERS OF CREWS

Port	Total No. Examined	Total No. Rejected	Per Cent Rejected
New York	13,089	107	0.82
New Orleans	10,566	112	1.06
Boston	3,645	17	0.47
TOTAL	27,300	236	0.86

PHYSICAL CAUSES FOR REJECTION OF MEMBERS OF CREWS

	New York	New Orleans	Boston
Malaria, clinical	2	–	–
Influenza	–	–	1
Syphilis, primary	–	7	–
Syphilis, secondary	–	1	–
Syphilis, period not specified	5	–	–
Soft chancre	10	28	1
Gonococcal infection except that of the eye or its adnexa	34	48	5
Anemia	2	–	–
Exophthalmic goitre	1	–	–
Epilepsy	–	1	–
Follicular conjunctivitis	4	–	–
Other diseases of the eye or its adnexa	1	–	1
Atheroma and other diseases of arteries	1	–	–

	New York	New Orleans	Boston
Adenitis inguinal	–	4	–
Bronchitis	–	–	1
Diseases of the teeth and gums	–	1	–
Tonsilitis	–	–	1
Hernia	34	20	5
Bright's disease	–	–	1
Non-venereal diseases of the male genital organs	8	–	–
Boils	–	1	–
Scabies	1	–	–
Dhobie Itch	1	–	–
Other diseases of the skin and adnexa	3	1	–
Other external violence	–	–	1
TOTAL	107	112	17

VACCINATIONS

New York	87
New Orleans	1,275
Boston	49

FUMIGATION

	New York	New Orleans	Boston
Steamships fumigated throughout	47	46	17
Holds only	–	–	–
Superstructure only	1	–	–
Forward quarters	19	2	4
Aft quarters	13	1	11
Separate rooms	18	4	6

EXPLANATORY NOTES

A list of abbreviations as used in the following tables — with their meanings — is given herewith:

M.—Male

F.—Female

T.—White persons born in temperate zones

O.—All persons other than "white persons born in temperate zones"

Emp.—Employee

Non-emp.—Non-Employee

Pass.—Passenger

O.—Office Calls

V.—Visits

N. Y.—New York

N. O.—New Orleans

Referring to the names of certain divisions which do not indicate the name of the country where located, the following explanation is given: Banes and Preston Divisions are located in Cuba; and the Tela Railroad Division and the Truxillo Railroad Company in Honduras.

The chart numbers referred to in some of the tables are taken from the "International List of the Causes of Sickness and Death." These chart numbers are used universally by public-health and city and state health departments and organizations.

The term "Employees" includes all persons appearing on our pay-rolls, including laborers and others employed on a part-time or hourly basis.

The term "Non-Employees" includes all persons formerly indicated by the classifications "Members of Families of Employees" and "Other Non-Employees" — i. e., all persons not included in the term "Employees."

In the present Report it will be noted that a change has been made in the method of classifying persons dependent upon the Company for medical attention. In reports issued prior to 1924 the subdivisions were based upon races — white and colored. This classification has been discontinued in the present Report, and patients are separated into two groups — (1) White persons born in temperate zones, and (2) "Others" — the latter including all individuals, irrespective of color or race, except white people with nativity in temperate zones. This method will make possible, for those interested, a determination of the effects of climatic conditions on people born in temperate zones and residing in a tropical climate. Of course, the separate groupings of "employees" and "non-employees," male and female, have been continued. It may be stated that the 1924 and 1925 Reports were compiled on the same basis as the present Report.

GENERAL INDEX

Alastrim 20
Almirante Hospital—Experiences with Plasmochin and Plasmochin Comp. 73
Almirante Hospital, Influenza Cases in 112
Almirante Hospital (Panama) Snake-Bite Cases Treated, 1922-26 237
Amoebiasis, Drugs Used in Treatment of 274
Amoebiasis, Intestinal, Diagnosis of 82
Anaemia in Tropics, Prevalence of 21
Anaesthesia, Spinal 223–228
Annular Calcified Scar (Case Report) 213
Anopheles albimanus as Predominating Mosquito Vector 15
Anopheles albimanus in Canal Zone 47
Anopheles albimanus in Cuban Divisions 46
Anopheles Breeding about Camps and Towns 42
Anopheles "Catches" 46
Anopheles Investigation 16
Anopheles Mosquitoes in Our Tropical Divisions 45
Anopheles Species Recorded from Cuba 46
Antigen for Complement Fixation, Preparation of 50, 51
Antivenin Institute of America 231–233
Antivenin, Intravenous or Hypodermic Injection of 235
Aphacia, Congenital, A Case of 148
Apothesine (Spinal Anaesthesia), Technique of Administering 227, 228
Arsenical Intoxications, Sodium Theosulphate in 138
Associated Diseases in Suspected Syphilitics (Table) 169
B. Coli, B. Typhosus, and B. Paratyphosus Infections Complicated by Tropical Diseases 141
B. Paratyphosus A and B in Stools, Incidence of 146
B. Paratyphosus, B. Typhosus, and B. Coli Infections Complicated by Tropical Diseases 141
B. Typhosus, B. Paratyphosus, and B. Coli Infections Complicated by Tropical Diseases (Case Reports) 141
Bacterial Dysenteries and Dysentery Bacilli, Classification of 89
Bacterial Dysenteries, Three Groups of 89
Banes Hospital, Cuba—Malaria and Blackwater Fever 47
"Bayer 205" in Equine Trypanosomiasis 263, 265
Blackwater Fever and Malaria—Banes Hospital, Cuba 47
Blackwater Fever in Meinicke and Kahn Tests 177
Blood Examinations (400) and Results with M.T.R. 170
Blood Transfusion in Severe Secondary Anaemia 221
Book Reviews 270–279
Buboes and Soft Chancroid 172
Butler's Serum Diagnosis for Syphilis (Macroscopic Slide Method) 179
Caraate, Aetiology of 130
Caraate in Colombia 123
Caraate (Pinta) as Indicating a Group of Dermatomycoses 123
Caraate, Wassermann Reactions in 170
Caraate, White, Interesting Case of 130, 131
Central America, Acute and Contagious Infections in 206, 207
Ceratopogoninae, Biting (Sandflies) at Puerto Castilla, Honduras 245
Cerebrospinal Meningitis, Pneumococcus Lanceolatus Causing Unusual Case of 105
Chancroid, Soft, and Buboes 172
Cholera, Tomb's Prescription for Treatment of 273
Cirrhosis, Toxic, One of the Five More Common Types 118
Clonorchiosis, A Case of 147
Colombia, Caraate in 123
Complications of Influenza 115
Consolidated Laboratory Report (Table) 340–343
Craig's "Manual of Parasitic Protozoa of Man," Review of 275
Cross-Immunity between Syphilis and Framboesia 163
Cuba, Syphilis and Framboesia among Haitian Laborers in 156
Death According to Percentage of Frequency, Cause of (Table) 212
Deaths and Diseases in Hospitals (Table) 212
Deaths by Age, Nativity, and Sex (Table) 298–299
Deaths by Disease, Classification of (Table) 302–309
Deaths by Nativity (Table) 300
Deaths—Ratio to Hospital Cases (Table) 212
Deeks, Dr. W. E., Letter of Transmittal by 15
Dengue, "Six-Day Fever," and Influenza 114
Diagnosis of Intestinal Amoebiasis 82
Diphtheria at Honduras, Antitoxic Immunity to 183
Disease, Deaths by, Classification of (Table) 302–309
Diseases and Deaths in Hospitals (Table) 212
Diseases Treated in Hospital Dispensaries, Classification of (Table) 330–333
Diseases Treated in Hospitals, Classification of (Table) 314–329
Diseases Treated on Passenger Steamships and by Port Medical Officers, Classification of (Table) 348
Dispensaries, Hospital, Classification of Diseases Treated in (Table) 330–333
Dysenteroides Genus (Table) 100
Dysentery, Bacillary, in Central America 206, 207
Dysentery Bacilli and Bacterial Dysenteries, Classification of 89
Ebertheae, Tribe (Table) 91
Embalming Fluid, Formulas for 269
Embalming Fluid Recommended for Use in Tropics 267
Embalming, General Instructions for 266
Embalming—List of Instruments and Materials Required 268, 269
Epididymitis, Acute Gonorrhoeal, Sodium Iodide Intravenous Injection in 164
Epilepsy, Removal of Cranial Exostosis for 216
Equine Trypanosomiasis in Colombia (Rengera or Derrengadera) 263
Equine Trypanosomiasis, Various Local Names for 264
Exostosis, Cranial, Removal of, in Epilepsy 216
Fevers in Tropics, Diagnosis of 273
Field Dispensaries, Record of (Table) 298, 299
Fluoroscopy Compared with Radiography, Advantages of 189
Fluoroscopy in Locating Foreign Bodies 190
Fractures Involving the Knee Joint, Severe 198
Framboesia and Syphilis among Haitian Laborers in Cuba 156
Gamete Carriers, Plasmochin and Plasmochin Comp. in Management of 76
Gangrene of the Skin, Symptomatology of 194, 195
Gangrene of the Skin with Streptococcal Subcutaneous Necrosis 194
Goiter, Notes on 135
Gonorrhoeal Epididymitis, Acute, Sodium Iodide Intravenous Injection in 164
Graft, Skin, in a Case of Extensive Injury 214
Granulomata Treated with Intravenous Tartar Emetic (5 Cases) 131
Graves' Disease Symptoms in Goiter 135
Gynatresia, Case of 137

Haemoglobinuric Fever, Haemostatic Serum (Intravenous) in Treatment of 63
Haemostatic Serum (Intravenous) in Treatment of Haemoglobinuric Fever 63
Haemostatic Serum (Lapenta) in Haemoglobinuric Fever 65, 66
Histoplasmosis 118, 119, 120
Histoplasmosis of the Lung Complicating Toxic Cirrhosis and Liver Cell Carcinoma 115
Histolytica Infection, Correct Diagnosis of 86
Honduras, Antitoxic Immunity to Diphtheria at 183
Hookworm 20
Hospital Cases, Ratio of Death to (Table) 212
Hospital Dispensaries, Record of (Table) 294–295
Hospitals, Classification of Diseases Treated in (Table) 314–329
Hospitals, Record of (Table) 292–293
Infections, Mixed 172
Influenza, Change in Nature of 110
Influenza, Dengue, and "Six-Day Fever" 114
Influenza in Central America 206
Influenza, Intestinal—Diagnostic Features Differentiating It from Typhoid 114
Influenza in the Tropics with Case Reports 108
Influenza, Pandemic Nature of 108, 109
Jamaica, Alastrim Epidemic in 20
Juxta-Articular Nodules in Syphilis 161, 162
Kahn and Wassermann Tests at Tela, Honduras 185
Kahn Precipitation Test and Meinicke Turbidity Reaction, Comparison of 177
Kahn's Test Compared to Wassermann Reaction 180
Kidney Infection by B. Coli 144
Knee Joint, Severe Fractures Involving the 198
Labor and Malaria 44
Laboratory Report, Consolidated (Table) 340–343
Laborers, Haitian, in Cuba, Syphilis and Framboesia among 156
Labor Recruits, Causes of Rejection of 22
Labor Recruits, Importance of Inspecting 23
Labor Recruits, Selection of 21
Lactogen in Infant Feeding in Tropics 21
Lankoides Genus (Table) 98
Letter of Transmittal by Dr. W. E. Deeks 15
Letters from Medical Superintendents, Extracts from 18
Liver Cell Carcinoma, Primary, and Toxic Cirrhosis with Histoplasmosis of the Lung 115
Lobar Pneumonia 20, 103
Lobar Pneumonia, Resistance of Native and Colored Populations to 20
Lugol's Solution after Operation 136
Machete vs. Microbe in Central America 205
Machete Wounds—Case Reports 210–212
Machete, Wounds from 208–210
Macroscopic Slide Method (Butler's) in Syphilis Diagnosis 179
Malaria—Acute, Sub-Acute, and Paroxysmal Defined 63, 64
Malaria and Blackwater Fever—Banes Hospital, Cuba 47
Malaria and Its Problems 15
Malaria and the Labor Force 44
Malaria and the Meinicke Reaction 170
Malaria and the Wassermann Reaction 170
Malaria, a Precipitin Test in 48
Malaria, Controversial Theories Concerning 277
Malaria Examinations at Tela 186
Malaria, Experiences with Plasmochin in (Preliminary Reports) 66
Malaria in Meinicke and Kahn Tests 177
Malaria in Tropics, Great Importance of 25
Malaria, Mercurochrome 220 Soluble in Treatment of 60
Malaria, Recent Knowledge and Control of 25
Malaria, Serology of 49
Malaria Control, Precipitin in 16
Malarial Fever, Tabular Summary of Plasmochin and Plasmochin Comp. in 79
Malarial Serum, Normal and Treated 49
"Manson's Tropical Diseases," Review of 270
Measles in Central America 206
Medical Department, Personnel of 280
Medical Department, Scope of 280
Medical Officers, Port, and Sanitary Inspector, Report of (Table) 349–350
Meinicke Turbidity Reaction and Kahn Precipitation Test, Comparison of 177
Meinicke Turbidity Reaction and Malaria 170
Meinicke Turbidity Reaction and Wassermann Test in Serodiagnosis in Tropics, Comparison of 173
Meinicke's Turbidity Reaction Compared to Wassermann Reaction 180
Meinicke Turbidity Reaction Results in 400 Blood Examinations 170
Meinicke's Directions How to Read the Meinicke Reaction 171
Meinicke's Third Modification (D.M. 3) Compared with Wassermann Reactions 180
Mercurochrome—Discussion of Its Uses 18
Mercurochrome, Intravenous, in Lobar Pneumonia 103
Mercurochrome, Intravenous Use of 62
Mercurochrome 220 Soluble in Treatment of Malaria 60
"Metadysentery Bacilli" 101
Meteorological Report (Table) 345
Microbe vs. Machete in Central America 205
Mortality Rate—Factors in Central America 206, 207
Mortality Rate, Tropical Diseases in Relation to 188
Mosquitoes, Anopheles, in Our Tropical Divisions 45
Ophidism in United States and Central America 229, 231
Organization of Medical Department and Vital Statistics 280–350
Orthodiagrams Obtained by Fluoroscopy 189
Panama (Bocas del Toro Province), Venomous Snakes in 238
Panama, Equine Trypanosomiasis in 265
"Parasitic Protozoa of Man" (Craig), Review of 275
Paratyphoid A, with Complications, Atypical Case of 142
Paratyphoid Fever 19
Passenger Service, Steamship, General Statement of (Table) 346–347
Pinta (Caraate) as Indicating a Group of Dermatomycoses 123
Placenta in Precipitin Test in Malaria 52 and ff.
Plasmochin 66–82
Plasmochin and Plasmochin Comp. in Malarial Fever—Tabular Summary 79
Plasmochin and Quinine in Malaria 44
Plasmochin Compared to Quinine, Action of 67
Plasmochin in Malaria, Conclusions concerning 71
Plasmochin, Recapitulation of Experiences with 79
Plasmochin Comp.—Death in Case of Malarial Fever 72
Pneumococcal Meningitis (Purulent), Case of Recovery from 106
Pneumococcus Lanceolatus as Cause of Cerebrospinal Meningitis 105
Pneumonia in Central America 206
Pneumonia, Lobar 20, 103
Pneumonia, Lobar—Cases Treated in Puerto Castilla Hospital 104

Pneumonia, Lobar, High Mortality from 103
Pneumonia, Lobar, Method Used in Treating . 104
Port Medical Officers and Sanitary Inspector, Report of (Table) 349–350
Post-Mortem Summary, (Truxillo R.R. Co. Hospital) Puerto Castilla, Honduras 186
Post-Operative Treatment of Wounds without Dressings 214
Potassium Permanganate in Pneumonia Treatment 105
Precipitin in Malaria Control 16
Precipitin Test in Malaria 48
Precipitin Test in Malaria, Summary of 56
Pregnancy, Bilateral Tubal (Case Report) . . . 219
"Protozoology" (Wenyon), Review of 278
Puerto Castilla, Honduras, Development and Control of Sandflies at 245
Puerto Castilla, Honduras, Special Snake-Bite Report from 240
Puerto Castilla Hospital, Lobar Pneumonia Cases Treated in 104
Quinine and Plasmochin in Malaria 44
Quinine Compared to Plasmochin, Action of 67 and ff.
Quinine, Plasmochin, and Plasmochin Comp. . . 76
Quirigua Hospital—Experiences with Plasmochin and Plasmochin Comp. 75
Radiography Compared with Fluoroscopy . . . 189
Repatriations, Record of (Table) 310–313
Sandflies at Puerto Castilla, Honduras, Development and Control of 245
Sandflies, Control of . . . . 251 and ff.
Sandflies—Habits of Adult and Effects of the Bite 247
Sandflies, Life History and Breeding Places . 248–250
Sandflies, Wind Velocity in Relation to (Table) 247
Sanitary Inspector and Port Medical Officers, Report of (Table) 349–350
Santa Marta Hospital, Typhoid Fever at . . . 19
Scar, Annular Calcified (Case Report) 213
Schick Test upon Tela (Honduras) Inhabitants . 183
Serodiagnosis in Tropics—Comparison of Wassermann Test and Meinicke Turbidity Reaction . 173
Serum Coagulation in Meinicke Reaction, How to Prevent 171
Serum Diagnosis for Syphilis, Butler's 179
Shigella Genus (Table) 96
"Six-Day Fever," Influenza, and Dengue . . . 114
Skin Graft in a Case of Extensive Injury . . . 214
"Sleeping Sickness" of Trypanosomiasis . 110, 111
Snake-Bite, Autopsy Record on Fatal Case of . 239
Snake-Bite Cases Reported from Tela Hospital, Tela, Honduras 241
Snake-Bite Cases Treated (1922–26) in Almirante Hospital, Panama 237
Snake-Bite Problem in United States and Central America 229
Snake-Bite Procedure, Advice in 234, 235
Snake-Bites—Special Report from Puerto Castilla, Honduras 240
Snakes in Bocas del Toro Province, Panama, Venomous 238
Snakes, Poison—the More Common Species Met 235, 236
Sodium Iodide in Gonorrhoeal Epididymitis, Conclusions regarding 167
Sodium Iodide Intravenous Injection in Treatment of Acute Gonorrhoeal Epididymitis . . . 164
Sodium Thiosulphate in Bichloride of Mercury and Arsenical Intoxications (3 Cases) 138
Sodium Thiosulphate, Method of Administering 139
Spinal Anaesthesia 223–228
Spinal Anaesthesia, Advantages and Disadvantages of 228
Spinal Anaesthesia, Brief History of 223
Spinal Anaesthesia, Special Advantages of 223, 225, 226
Spinal Anaesthesia, Technique of . . . 223, 224, 225
Spinal Anaesthesia, Untoward Effects of . . . 225
Splenomegaly, Wassermann Reactions in . . . 170
Staff, Medical, Increase in Contributions of . . . 17
Statistics, Vital (Tables) 284–350
Steamship Passenger Service, General Statement of (Table) 346–347
Stool Examinations, Liability of Error in . . . 84
Stool Material, Methods of Obtaining 87
Stools, B. Paratyphosus A and B in 146
Streptococcal Subcutaneous Necrosis and Gangrene of the Skin 194
Summary of Work Done and Vital Statistics (Table) 284–291
Superintendents, Medical, Extracts from Letters of 18
Surgical Report (Table) 334–338
Symbiotic Fermentation Phenomenon—Differentiation between Shiga, Flexner, and "Y" (Table) 95
Syphilis and Framboesia among Haitian Laborers in Cuba 156
Syphilis, Butler's Serum Diagnosis for 179
Syphilis in the Tropics (with Case Reports) . . 149
Syphilitics, Associated Diseases in (Table) . . . 169
Tela R.R. Company Hospital—Experiences with Plasmochin and Plasmochin Comp. 77
Tela R.R. Hospital Laboratory Report (1926) . . 184
Tela R.R. Hospital Results with Kahn Test . . 181
Tela Schick Tests 183
Toxic Cirrhosis and Primary Liver Cell Carcinoma with Histoplasmosis of the Lung 115
Tropical Diseases in Relation to Mortality Rate 188
"Tropical Diseases" (Manson), Review of . . . 270
Trypanosomiasis, Equine, (Rengera or Derrengadera) in Colombia 263
Trypanosomiasis, Equine, Various Local Names for 264
Typhoid and Intestinal Influenza—Diagnostic Features Differentiating Them 114
Typhoid Fever 19
Typhoid Fever, Atypical Temperature in . . . 141
United Fruit Company and Antivenin Institute of America 233
U.S.P.H.S. Survey 16
Vaccination against Typhoid Fever 19
Veino Aluminum Syringe for Embalming . . 267, 269
Venereal Diseases 20
Vital Statistics, Summary of Work Done and (Table) 284–291
Vital Statistics (Tables) 284–350
Wassermann and Kahn Tests at Tela, Honduras 185
Wassermann Reaction and Malaria 170
Wassermann Reactions in Caraate and Splenomegaly 170
Wassermann Reactions, Positive—Percentage Found Associated with Various Diseases . . 168
Wassermann Test and Meinicke Turbidity Reaction in Serodiagnosis in Tropics, Comparison of 173
Wassermann Tests Analyzed (Table) 169
Wassermann Tests—Results by Races (Table) . 168
Wenyon's "Protozoology," Review of 278
Wounds from the Machete 208–210
Wounds from the Machete—Case Reports . 210–212
Wounds—Post-Operative Treatment without Dressings 214
X-Ray Examinations, Number and Classification of (Table) 344
X-Ray Film, New Type of 189

GORDON-TAYLOR INC.
Cambridge, Mass.